Beyond Recovery:
Restoration for the Future

SERCAL 2019 in Santa Barbara April 10-12

the 26th Annual Conference of the
California Society for Ecological Restoration

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Beyond Recovery: *Restoration for the Future*

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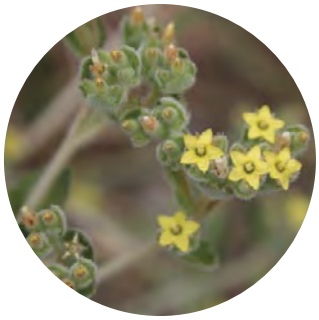

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Wednesday, April 10 Day One: Conference

8–9am **Registration Check-in** | **Sponsor & Poster Set-up** | **Hosted Breakfast Buffet**

9–10am **Welcome** Greg Andrew, Mauricio Gómez, and Will Spangler
Plenary Session Dan Gluesenkamp, California Native Plant Society

10–10:30am **Hosted Coffee Break**

10:30–Noon **Concurrent Technical Sessions**
Fire | Stream & Fisheries | Grassland Ecosystems

Noon–1:30pm **Hosted Buffet Lunch**

1:30–3pm **Concurrent Technical Sessions**
Coastal / Sea Level Rise | Stream & Fisheries | Grassland Ecosystems...Threats, Pests, & Pathogens

3–3:30pm **Hosted Coffee Break**

3:30–5pm **Concurrent Technical Sessions**
Coastal / Sea Level Rise | Stream & Fisheries | Threats, Pests, & Pathogens

5–7pm **Poster Reception & Student Poster Contest** | **Hosted Appetizers** | **Craft Brews**

Sponsor Booths Open

Posters on Display

Raffle Items on Display
Proceeds benefit Student Scholarship fund.

Thursday, April 11 Day Two: Conference

8–9am **Hosted Breakfast Buffet**

9–10am **Plenary Session** Chad Hanson, John Muir Project

10–10:30am **Hosted Coffee Break**

10:30–12pm **Concurrent Technical Sessions**
Coastal / Sea Level Rise | Mitigation / Conservation | Technology & Tools

12–1:30pm **Hosted Buffet Lunch** | **Award Presentations** | **Member Meeting** | **Raffle Drawings**

1:30–3pm **Concurrent Technical Sessions**
Coastal / Sea Level Rise...Water Conservation | Mitigation / Conservation | Technology & Tools

3–3:30pm **Hosted Coffee Break**

3:30–5pm **Concurrent Technical Sessions**
.Water Conservation | Mitigation / Conservation | Technology & Tools...Thinking Outside the Box

Raffle Items on Display
Drawing at Lunch

Sponsor Booths Open

Posters on Display

Friday, April 12 Day Three: Post-Conference Fieldtrips OR CNGA Workshop

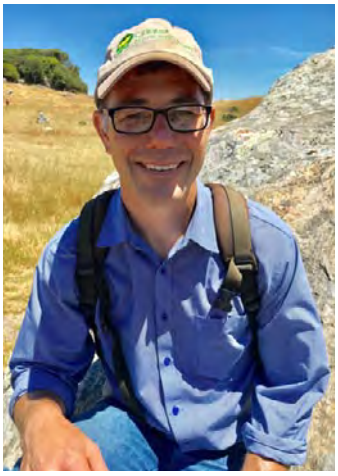
Almost everything is full! See registration table for more information or to sign up for a waiting list.

Wednesday, April 10 Day One: Conference

8:00–9:00am	**Registration Check-in** | **Sponsor & Poster Set-up** | **Hosted Breakfast Buffet**
9:00–10:00am	**Welcome** SERCAL President Greg Andrew & Conference Chairs Mauricio Gomez and Will Spangler **Plenary Speaker:** Dan Gluesenkamp, California Native Plant Society

The worst is yet to come, but so is the best: Restoration, biodiversity, and our role in the transition to an incredible 21st century California

For over 50 years, our community has worked to save and restore California's celebrated wild gardens. During those decades, the human population has doubled and biodiversity conservation in California has been dramatically transformed. Against all odds, using a growing diversity of conceptual and technical approaches, we have somehow managed to save most of what makes California special. As we look to the future, we see new threats and wonder how to save California for the future. Dan Gluesenkamp will speak about places, priorities, and projects, and how new generations of Californians, with new ideas and diverse voices, will leverage the incredible successes of past struggle toward building a future we all can love. Together, we will explore a vision for how we will learn and work to make a real and lasting difference, transition California to shared systems that secure our treasured biodiversity, and with our success inspire the rest of the world to do the same for their special lands.



Dan Gluesenkamp is Executive Director of CNPS, and was previously E.D. of Calflora and Director of Habitat Protection and Restoration for Audubon Canyon Ranch's thirty preserves. He earned his Ph.D. at UC Berkeley studying plant-insect interactions in native and invasive thistles, and has led research and restoration projects across California. A co-founder of the California Invasive Plant Council and of the Bay Area Early Detection Network (BAEDN), in 2009 Dan discovered a presumed-extinct Franciscan manzanita (*Arctostaphylos franciscana*) plant growing on a traffic island at the Golden Gate Bridge.

10:00–10:30am	**Hosted Coffee Break**
10:30–Noon	**Concurrent Technical Sessions** *(unless otherwise noted, four 20-minute talks with Q&A at end)*

SANTA BARBARA ROOM

FIRE (15-min ea)

10:30 Tanessa Hartwig — Fish, Fire, and Flows: Steelhead Recovery in the Santa Monica Bay

10:45 Kyle Evans — Southern California Steelhead Monitoring: Post Thomas Fire Challenge

11:00 Denise Knapp — Backcountry Adventures to Inform Habitat Restoration

11:15 Sabrina Drill — Sustainable and Fire-Resistant Landscaping – Before and After Fire

11:30 Tom Bell — Using drones to monitor impacts and recovery in disturbed ecosystems

11:45 Panel discussion

CABRILLO ROOM

STREAM & FISHERIES

10:30 Wendy Katagi — Los Angeles River Fish Passage and Habitat Structures

10:50 Candice Meneghin — Watershed Restoration Strategies for Southern steelhead Recovery on Gaviota Creek

11:10 Timothy Robinson — Quiota Creek Restoration / Fish Passage, a Nearly Complete Watershed Plan

11:30 RJ Van Sant — Stream Restoration Design in an Anthropongenically Altered World

11:50 Q&A w/presenters

OCEANVIEW ROOM

GRASSLAND ECOSYSTEMS

10:30 Pat Reynolds — Lessons Learned from Milkweed Establishment Trials and Commercial Seed Production

10:50 Justin Luong — Can functional traits inform coastal prairie restoration?

11:10 Lawrence Ford — Grazing to Benefit Endangered Ohlone Tiger Beetle at Glenwood Preserve

11:30 Angie Harbin-Ireland — Field-Fit Solutions For Vernal Pool Enhancement and Creation

Noon–1:30pm	**Hosted Buffet Lunch**

Wednesday, April 10 Day One: Conference

1:30–3:00pm **Concurrent Technical Sessions** *(four 20-minute talks with Q&A at end)*

SANTA BARBARA ROOM

COASTAL / SEA LEVEL RISE

1:30 Jason Drew — Considering management and policy, critical to coastal restoration planning

1:50 Monique Fountain — A multipronged approach to tidal marsh restoration in Elkhorn Slough

2:10 Karen Tanner — Testing novel science-based strategies to improve salt marsh restoration success

2:30 Lisa Stratton — North Campus Open Space Restoration Project: A Sea Level Rise Adaptation Model

2:50 Q&A w/presenters

CABRILLO ROOM

STREAM & FISHERIES

1:30 Jai Singh — Butano Creek Channel Reconnection and Resilience Project

1:50 Sarah Phillips — Engaging Local Communities to Promote Urban Watershed Health & Understanding around Salmonid Habitat Needs

2:10 Katherine Dudney — River Recovery Three Years After Removal of San Clemente Dam

2:40 Extended Q&A w/presenters

OCEANVIEW ROOM

GRASSLAND ECOSYSTEMS

1:30 Madeleine Nolan — Are Populations of Stipa pulchra Adapted to Local Climates?

1:50 Brianne Palmer — Using biocrusts as a restoration tool in native grasslands

2:10 Q&A w/presenters

THREATS, PESTS, & PATHOGENS

2:20 Shannon Lynch — IPM building blocks to control invasive shot hole borers–Fusarium dieback

2:40 Chris Kallstrand — Pest Monitoring – A Rapid Assessment Protocol

3:00–3:30pm **Hosted Coffee Break**

3:30–5:00pm **Concurrent Technical Sessions** *(unless otherwise noted, four 20-minute talks with Q&A at end)*

SANTA BARBARA ROOM

COASTAL / SEA LEVEL RISE

3:30 Eddie Divita — Quantifying Ecology-Hydrology Linkages to Support Restoration Design in Intermittently Tidal Estuaries

3:50 Elihu Gevirtz — Restoration Potential of the Gaviota Creek Estuary

4:10 Jennifer Zell — ADAPT and THRIVE: Strategies for life along a dynamic coastline

4:30 Steve Pye — Rapid, Large-Scale Rhizomatous Grass Plantings in San Francisco Bay Tidal Wetlands

4:50 Q&A w/presenters

CABRILLO ROOM

STREAM & FISHERIES

3:30 Carl Jensen — Utilizing a Public-Private Partnership to Restore Native Fish Habitat in the Yolo Bypass: The Yolo Flyway Farms Restoration Project

3:50 Dan Chase — Conservation Banking as a Tool for Riparian and Floodplain Restoration

4:10 Ross Taylor — Martin Slough Enhancement Project – Humboldt Bay, California

4:30 Extended Q&A with presenters

OCEANVIEW ROOM

THREATS, PESTS, & PATHOGENS

3:30 Lindsay Teunis — Advancing Riparian and River Restoration in a Time of Uncertainty

3:50 Tedmund Swiecki — Assessing threats posed by Phytophthora in the Santa Clara NCCP plan area

4:10 Elihu Gevirtz — Attempting to Eradicate Limonium duriusculum in Carpinteria Salt Marsh

4:30 Linnea Spears-Lebrun — Implications of Unauthorized Human Uses on Riparian/Stream Restoration

4:50 Q&A w/presenters

5:00–7:00pm **Poster Reception & Student Poster Contest | Hosted Appetizers | Craft Brews**

Kudos to the Super Heroes at Cal-IPC, Ecological Concerns, Habitat West, Wildlands, and WRA for providing FULL SCHOLARSHIPS for 8 student presenters. In addition, our raffle in 2018 —proceeds of raffle items generously gifted by our sponsors and the SERCAL Board and YOUR practically selfless purchase of raffle tickets — provided full scholarships to 12 students! Thank you, everyone!

Thursday, April 11 Day Two: Conference

8:00–9:00am	**Hosted Breakfast Buffet**
9:00–10:00am	**Announcements** Conference Chairs Mauricio Gomez and Will Spangler **Plenary Speaker:** Chad Hanson, John Muir Project

Chad Hanson co-founded the John Muir Project in 1996. He first became involved in national forest protection after hiking the 2,700-mile length of the Pacific Crest Trail from Mexico to Canada with his older brother in 1989. During this hike he witnessed firsthand the devastation caused by rampant commercial logging on our National Forests in California, Oregon and Washington.

Chad finished his Bachelor of Science degree from UCLA after completing the Pacific Crest Trail and then attended law school at the University of Oregon, during which time he also began his career as an environmental advocate working for Native Forest Council and volunteering for the Sierra Club. Chad earned his law degree in 1995, and started the John Muir Project shortly thereafter.

In 2003 Chad returned to school, and earned his Ph.D. in Ecology from the University of California at Davis in 2007, with a research focus on forest and fire ecology and the rare wildlife species that depend upon post-fire habitat in forests of the Sierra Nevada and elsewhere in the western U.S.. He has published an impressive list of scientific research papers on forest and fire ecology, wildlife use of burned forest and fire history and trend.

Chad Hanson playing a recorded woodpecker call in Yosemite National Park while searching for black-backed woodpeckers, the symbol of the scientific and political debate over fires.

10:00–10:30am	**Hosted Coffee Break**
10:30–Noon	**Concurrent Technical Sessions** *(unless otherwise noted, four 20-minute talks with Q&A at end)*

SANTA BARBARA ROOM

COASTAL / SEA LEVEL RISE

10:30 William Hoyer — Habitat Restoration on San Nicolas Island

10:50 Katie Smith — Restoration or Reconciliation? Shifting paradigms and strategies for conserving threatened wildlife in the San Francisco Estuary

11:10 Peter Howorth — Monitoring Effects of Future Sea Level Changes Now: Pinniped Displacement

11:30 Elihu Gevirtz — Restoration of an Estuary: A 10-Year Retrospective of Work in Goleta Slough

11:50 Q&A w/presenters

CABRILLO ROOM

MITIGATION / CONSERVATION

10:30 Andrew Cawley — Mitigation Banking: An Engine for Restoration

10:50 Ashley Zavagno — Restoring ecological processes: challenges with uncertainty in mitigation banking

11:10 Lindsay Teunis — Maximizing Mitigation on Public Lands: the Win-Win-Win, Roadblocks, and Solutions

11:30 Ron Unger — CDFW's Landscape Conservation and Planning Program Toolbox – got new tools?

11:50 Q&A w/presenters

OCEANVIEW ROOM

TECHNOLOGY & TOOLS

10:30 Drew Mealor — Using Plant Species Climate Tolerances and Climate Projections to Design Climate-Smart Riparian Restoration Projects

10:50 Brad Anderson — Climate-driven vegetation changes at the Dangermond Preserve: Implications for restoration

11:10 Ian MacLeod — Walker Mine Tailings, Part 1: Revegetating stubbornly barren tailings

11:30 Samantha Birdsong — Walker Mine Tailings, Part 2: Utilizing unmanned aircraft systems for site assessment

11:50 Q&A w/presenters

Thursday, April 11 Day Two: Conference

Noon–1:30pm **Hosted Buffet Lunch, Award Presentations, Member Meeting, and Drawing of Raffle Prizes**
1:30–3:00pm **Concurrent Technical Sessions** *(unless otherwise noted, four 20-minute talks with Q&A at end)*

SANTA BARBARA ROOM

COASTAL / SEA LEVEL RISE

1:30 Jan Novak — Middle Harbor Enhancement Area: An Early Restoration Experiment in Subtidal Habitat

1:50 Cassie Pinnell — Montezuma Wetlands: Three Decades of Tidal Marsh Restoration Lessons Learned

2:10 Q&A w/presenters

WATER CONSERVATION

2:20 Anna Schiller — Sustainable Groundwater Management and Restoration on Private Lands

2:40 Regina Hirsch — Water Conservation Toolkits for Instream Flow Enhancement

CABRILLO ROOM

MITIGATION / CONSERVATION

1:30 Tim Vendlinski — Conserving Suburban Natural Areas: The Case of Rancho Del Paso

1:50 Judy Perkins — Implementing the National Seed Strategy for Mojave Desert Restoration

2:10 Mark Young — Markham Ravine Restoration – Early Implementation for the Placer County Conservation Plan

2:30 Lucy Genua — Analyzing Historical Aerial Photographs and Vegetation Maps to Inform Conservation and Restoration at the Dangermond Preserve

2:50 Q&A w/presenters

OCEANVIEW ROOM

TECHNOLOGY & TOOLS

1:30 Sundaran Gillespie — UAV/RTK data collection for active construction oversight and as-built documentation

1:50 Jon Walker — Restoration Project Information Management and Monitoring, Streamlined Web Interface

2:10 Seongjun Kim — Data visualization tool for multidisciplinary communication in restoration

2:30 Patricia Valcarcel — Environmental DNA (eDNA) use for project planning and species detection

2:50 Q&A w/presenters

3:00–3:30pm **Hosted Coffee Break**
3:30–5:00pm **Concurrent Technical Sessions** *(unless otherwise noted, four 20-minute talks with Q&A at end)*

SANTA BARBARA ROOM

WATER CONSERVATION

3:30 Barry Nerhus — Using an Urban Runoff Source to Create a Thriving Wetland System

3:50 Kristen Dybala — Multiple benefits of riparian restorations in California: documenting, communicating, optimizing

4:10 Jane Gray — Panel with Steph Wald (Central Coast Salmon) and Dominic Roque (CCRWQCB): Water Conservation for Improved Habitats How water conservation ripples through restoration from landscape design to instream flows

4:30 Megan Wolff — Achieving Resilience at White Point Nature Preserve

4:50 Q&A w/presenters

CABRILLO ROOM

MITIGATION / CONSERVATION

3:30 Mahala Guggino — San Luis Rey Mitigation Bank – Reviewing a Riparian Restoration during Habitat Establishment

3:50 Mary Carroll — Active Restoration of Two Short-lived Narrow Endemic Herbaceous Species

4:10 Terah Donovan — Design-Build and Design Intent: A Restoration Paradigm for Successful Stewardship (40 min. presentation)

4:50 Q&A w/presenters

OCEANVIEW ROOM

TECHNOLOGY & TOOLS

3:30 Greg Lohse — Using Cloud-based Technology to Create Efficiency in Restoration Work

3:50 Q&A w/presenters

THINKING OUTSIDE THE BOX

4:00 Christopher Lortie — Open meta-analysis is a reproducible environmental solution

4:20 Andrew Lanes — Teaching Ecological Restoration to Future Generations

4:40 Sue Gardner — Speak to Be Remembered: The Art of Storytelling

5:00pm Conference Closes Thank you for being a part of this gathering!

Friday, April 12 Post-Conference Fieldtrips and CNGA Workshop

See pages 56–59 for details; see the SERCAL desk for getting on the waiting lists! Waiting lists close at 5pm Thursday.

Increasing resiliency to sea-level rise in coastal, island, and estuarine projects:

Coastal Restoration and Sea Level Rise Adaptation

Chair: Jeannine Ross, KMEA

Wed 10 April, 1:30pm–5pm and Thu 11 April, 10:30am–2:10pm — *Santa Barbara Room*

Abstracts listed alphabetically by presenter (*)

Active Restoration of Two Short-lived Narrow Endemic Herbaceous Species

Mary Carroll

Arcadis, 735 Tank Farm Road, Suite 150, San Luis Obispo 93401
mary.carroll@arcadis-us.com

Ventura Marsh Milk-Vetch (*Astragalus pycnostachyus* var. *lanosissimus*), a short-lived herbaceous perennial, was thought to be extinct in the wild until almost 400 individuals were discovered by USFWS on a former oil waste site in Oxnard, CA in August 1997. Classified as an obligate wetland species, this species is generally intolerant of flooding and is often outcompeted by native rhizomatous species. This "wild" population declined to 21 individuals in 2009 and, through active intervention, has recovered to over 200 reproductive individuals. Outplantings were installed nearby in 2016 and 2017. Pismo clarkia (*Clarkia speciosa* subsp. *immaculata*), an annual species confined an area approximately 15 miles long by 7 miles wide occurs only between San Luis Obispo and Nipomo Mesa in fragmented colonies. Active restoration of a weedy area through topsoil salvaging, seeding, and weed abatement has been conducted over a 9-year period beginning in 2009. Factors affecting establishment of sustainable populations of these short-lived species include an understanding of substrates, moisture requirements, phenology, competition, herbivory, and other factors.

Quantifying Ecology-Hydrology Linkages to Support Restoration Design in Intermittently Tidal Estuaries

Eddie Divita*[1], Lisa Stratton[2], Dane Behrens[1], and Bob Battalio[1]

[1]Environmental Science Associates, **edivita@esassoc.com**. [2]University of California, Santa Barbara, Cheadle Center for Biodiversity and Ecological Restoration.

Many intermittently tidal lagoons along the California coast have been adversely impacted by agriculture, development, and flood protection projects, resulting in the loss of wetland habitats and the disruption of migratory pathways for anadromous fish. We will present a design approach for restoring resilient intermittently tidal lagoon landscapes that is based on quantifying linkages between hydrology, coastal geomorphology, and ecological design criteria. Intermittently tidal coastal lagoons are dynamic landscapes that experience highly variable hydrologic conditions due to their sensitivity to both coastal and watershed processes. These landscapes transition between a distinct hydrologic states, such as tidally influenced estuaries, perched ponds, and evaporative basins, in response to variations in inflows from the watershed and geomorphic changes at the beach berm/lagoon inlet. We will describe an approach for habitat restoration design that characterizes the specific balance of processes driving hydrologic conditions for a given lagoon, based on the following steps: (1) developing a quantified conceptual model (QCM) that describes the balance of coastal and watershed processes affecting the lagoon, (2) identifying correlations between hydrologic conditions and key habitat types, and (3) applying the QCM to describe expected near- and long-term conditions. Using the recently-constructed North Campus Open Space Restoration Project as a case study, we will demonstrate how this methodology is used to quantify expected hydrologic conditions and resulting ecological outcomes under different design alternatives, and how this same approach can be used to model potential future conditions scenarios with sea-level rise and climate change.

Considering Management and Policy, Critical to Coastal Restoration Planning

Jason Drew* & Mack Casterman*

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jdrew@ncenet.com
mcasterman@ncenet.com

Poplar Beach Park in the City of Half Moon Bay is home to the California Coastal Trail, critical coastal prairie habitat and a variety of wetland resources. Recession of adjacent coastal bluffs from wave and tidal action as well as erosion features from local drainage patterns threaten critical habitat, wetland resources, the structural viability of the Trail, and have created numerous safety hazards. A multi-disciplinary team evaluated available information and conducted a comprehensive field analysis of existing conditions. The analysis resulted in identifying and presenting a series of resource and trail planning scenarios developed using 50- and 100-year sea level rise estimates, associated bluff recession rates and estimates of erosion caused by onsite drainage using aerial photography. More importantly the analysis identified key management questions and critical policy considerations that needed to be addressed before the City could make cost-effective resource, habitat and trail restoration investments in the Park. Using the Poplar

Beach Park as a case study, this presentation will highlight the importance of fully evaluating existing conditions, understanding underlying causes, and documenting and resolving key management and policy questions as the first critical step in effective coastal restoration planning.

A Multipronged Approach to Tidal Marsh Restoration in Elkhorn Slough

Monique Fountain*[1], R Jeppesen[1], C. Endris[1], A. Woolfolk[1], E. Watson[2], I. Aiello[3], S. Fork[1], J. Haskins[1], K. Tanner[1,4], A. Thomsen[5], A. Lapides[1], and K. Wasson[1,4]

[1]Elkhorn Slough National Estuarine Research Reserve **monique@elkhornslough.org** [2]Department of Biodiversity, Earth & Environmental Sciences, Drexel University, Philadelphia PA **elizabeth.b.watson@gmail.com** [3]Moss Landing Marine Labs **iaiello@mlml.calstate.edu** [4]UC Santa Cruz **karen.e.tanner@gmail.com** [5]CSU Monterey Bay **athomsen@csumb.edu**

Over the past 150 years, human actions have altered the tidal, freshwater, and sediment processes that are essential to support and sustain healthy ecosytems at Elkhorn Slough (Monterey County). Large areas of tidal marshes were diked and drained in the 20th century. This caused subsidence and when dikes failed, the areas were too low to support healthy marsh. In these previously diked areas the salt marsh habitat is almost entirely gone with just sparse fringing marsh in narrow bands along the shoreline and on dikes still high enough to have infrequent tidal inundation. In addition to this habitat degradation, modeling suggests most of Elkhorn Slough's remaining marshes will be lost within 50 years due to sea-level rise. The 65-acre Hester marsh restoration project is the first large-scale restoration of its type in this estuary. Over 200,000 cubic yards of soil were needed to bring the marsh up to a sustainable elevation, high in the tidal frame. The project used cutting-edge drone technology to track implementation and incorporated a large ecotone planting experiment. Restoring this degraded habitat took many hands from planning to planting and this project highlights the importance of a collaborative, interdisciplinary approach to restoring sustainable habitat for the future.

Restoration of an Estuary: A 10-year Retrospective of Work in Goleta Slough

Elihu Gevirtz

Senior Ecologist, Channel Islands Restoration 805.448.4175 **elihu@cirweb.org**

The effort to restore the upper portion of Goleta Slough between the Santa Barbara Airport and UCSB began in 2009 with removing structures, pavement, and thousands of cubic yards of soil that had filled a portion of the estuary in order to create a military airport during World War II. Removal of the fill was followed by planting more than 17,000 native plants, and installing a culvert that would convey tidewater to the wetlands. One final piece remains to be done which is removal of "tide gates" (barriers that stop the salt water from moving up into the wetlands). This talk will present the results ten years later, and describe current efforts to study the possible effects of removing the barriers to tidal circulation and to remove the barriers entirely. The impact of the project in relation to sea level rise will be discussed.

Restoration Potential of the Gaviota Creek Estuary

Elihu Gevirtz*[1] and Wayne Ferren, Jr.[2]

[1]Senior Ecologist, Channel Islands Restoration 805.448.4175 **elihu@cirweb.org** [2]Botanist and Restoration Ecologist, Retired 805.722.2324 **wrfjr70@gmail.com**

The Gaviota Creek Estuary has been subject to filling, installation of a low-flow creek crossing, and other challenges. We will present our findings of a study that we published in 2017. This paper is intended to be a step toward development of an estuary restoration plan. We provide an analysis of the historic extent of the estuary and some of the features that might have characterized it. We also provide descriptions of the special-status species that are known to

occur or that have occurred in the estuary and the creek, discuss potential goals and opportunities for restoration and some of the functions that a restored estuary, creek, beach, and sand dunes could provide in the future, including habitat for special-status species. The paper was funded by and prepared for The Coastal Ranches Conservancy.

Monitoring Effects of Future Sea Level Changes Now: Pinniped Displacement

Peter C. Howorth*[1], Tara Schoenwetter[2], and Thomas Mulroy[2]

[1]Marine Mammal Consulting Group, Inc. **phoworth@cox.net** [2]Leidos, Inc. **tara.schoenwetter@leidos.com** [3]**thomas.w.mulroy@leidos.com**

In investigating pinniped displacement as a result of sea level changes, various pinniped records were examined from commercial collections, government studies, mitigation measures, and publicly accessible haul-outs and rookeries. Since 1991, extensive documentation occurred at Vandenberg Air Force Base, where unstable bluffs resulted in significant landslides, displacing harbor seals from several locations. Some seals occupied alternate haul-out sites. However, the landslides also resulted in extensive sedimentation, sanding-in offshore rocks and increasing opportunities for coyotes to prey on the seals. A large landslide that occurred at Santa Cruz Island resulted in the complete and permanent abandonment of a colony of 1,000 to 2,000 sea lions. Pinnipeds movement patterns include human inhabited areas, which can be controversial. At Children's Pool in La Jolla, harbor seals took over a beach created by humans, limiting public access. A similar process occurred in Carpinteria, resulting in a seasonal closure of a natural beach. In some cases, the public supports the presence of pinniped colonies; however, sometimes the government and/or special interest groups oppose such colonies. Pinnipeds are distributed throughout California, some species undergoing very large migrations. They are highly adaptable to changes in the environment, sometimes even acclimating to the presence of humans. Restoration or creation of habitats may sometimes be counterproductive, since pinnipeds seem to select their own sites, usually based on the presence or absence of predators, humans, and dogs. Even if the habitat seems promising, the pinnipeds may not adopt it.

Habitat Restoration on San Nicolas Island

William Hoyer*[1] and Elihu Gevirtz[2]

Natural Resources Manager, San Nicolas Island, Environmental Division, Naval Base Ventura County, 805.989.3444 (SNI), 707.239.1485 (Mobile), **william.hoyer@navy.mil** [2]Senior Ecologist, Channel Islands Restoration, 805.448.4175, elihu@cirweb.org

The United States Navy, in collaboration with Channel Islands Restoration, has engaged in a major effort to restore habitats on San Nicolas Island for rare species including San Nicolas Island Night Lizard (*Xantusia riversiana riversiana*), San Nicolas Island Fox (*Urocyon littoralis dickeyi*), Desert Box-Thorn (*Lycium brevipes)*, Beach Spectacle-Pod (*Dithyrea maritima*), and others. Revegetation is being accomplished by propagation using seeds and cuttings collected and propagated exclusively on the island. Over the past six years, we have propagated and planted more than 30,000 native plants. We will describe some of the techniques, results, and challenges, on this dry and windy island.

Middle Harbor Enhancement Area: An Early Restoration Experiment in Subtidal Habitat

Jan Novak*[1], Keith Merkel[2], Jon Amdur[3], and Eric Jolliffe[4]

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The Port of Oakland (Port) operates the third-largest container port on the west coast. The Middle Harbor Enhancement Area (MHEA) is a restoration site associated with the Port's Vision 2000 Plan, which deepened, and widened, the shipping channels to allow larger container ships to access the Port's marine terminals. As part of the agreement with regulatory agencies, the MHEA, a former 40-foot deep dredged naval harbor, was restored to create shallow subtidal and intertidal habitat. The creation of MHEA utilized 5.8 million cubic yards of dredged material to create the 189-acre restoration site. A primary goal of the MHEA was to create 55 acres of eelgrass suitable habitat and 15 acres of eelgrass habitat. Eelgrass planting is planned for early 2019, and physical and biological performance monitoring metrics have suggested that the eelgrass suitable habitat metric has been met (and exceeded). The project was designed and implemented prior to consideration of sea level rise in restoration; however, added resilience was ultimately garnered during final sculpting in 2014. The project area has been identified as a birding hotspot by the Golden Gate Audubon Society, providing foraging habitat for many bird species, including the endangered California Least Tern. While the project is close to achieving its primary goal of creating open space and wildlife habitat at the urban/nature interface of an industrial container port, it faces challenges that offer lessons learned for future restoration design, including setting achievable schedules and habitat targets, complicating effects of collaborative projects, and meaningful public engagement.

Montezuma Wetlands: Three Decades of Tidal Marsh Restoration Lessons Learned

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The Montezuma Wetlands Project is a multi-phase project that uses dredged sediment to raise elevations in diked,

subsided baylands to restore 1,900 acres of a tidal wetland ecosystem, including seasonal wetlands and upland transition zone habitat. This project is unique as a private for-profit restoration project that is designed to accept sediment not suitable for unconfined aquatic disposal ("foundation" sediment that is buried under cleaner surface sediment). The project has operated successfully for three decades as a successful private-public partnership that is accomplishing its restoration goals in support of the Long-Term Management Strategy (LTMS) established by a joint effort of the Corps and other federal and state agencies to maximize the use of beneficially reusing sediment dredged from the SF Estuary. Since 2003, this project has accepted nearly 7mcy of dredged sediment and will be breaching its first phase in fall 2019. Throughout this time, this project has worked to adaptively manage and improve its restoration methods to increase resiliency for sea-level rise (SLR) and changing conditions. Updates to the project have included: 1) building additional transition zone habitat to improve SLR resiliency and refugial habitat; 2) raising high marsh target elevations for SLR; 3) increasing habitat patch-size for improved connectivity of tidal and transition habitats; 4) reducing the number of engineered levees to minimize construction impacts, reduce predator access, and improve natural marsh development; 5) creating nesting habitat for California least terns; 6) improvements to salt marsh harvest mouse management; and 7) improvements to re-vegetation strategies and vegetation management.

Rapid, Large-scale Rhizomatous Grass Plantings in San Francisco Bay Tidal Wetlands

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Native, rhizomatous grasses such as Creeping Wild Rye (*Elymus triticoides*) are desirable species in transitional habitat zones of tidal wetland restoration projects around San Francisco Bay for their ability to tolerate harsh conditions, rapidly colonize soils following construction, and because they allow managers to employ broad-leaf herbicides to suppress invasive species without damaging native grasses. A 1,000-acre tidal wetlands restoration project managed by Sonoma Land Trust (SLT) at Sears Point in San Pablo Bay has large natural populations of Creeping Wild Rye; a unique resource recently utilized in an effort to establish native vegetation on a 2.5-mile-long levee constructed as part of the project. In 2018 and 2019, Pacific Watershed Associates (PWA), in partnership with SLT and the San Pablo Bay National Wildlife Refuge (SPBNWR), planted Creeping Wild Rye on the levee in two phases using a unique planting methodology scaled to one of the largest tidal wetlands projects in California. Over both phases, PWA successfully planted 2.5 miles of the levee with 13,290 plants (clumps of soil and rhizomes). PWA's pragmatic techniques for a team of 2-3 staff to quickly harvest, process, and plant Creeping Wild Rye allows

for rapid planting of rhizomatous grasses on a large scale and better ensures rhizome viability between harvest, planting, and overwintering in dry, saline conditions. Based upon monitoring of the Phase 1 plantings, these methods yielded a survival rate of 42% during a drought year, the highest of any Creeping Wild Rye planting implemented at Sears Point.

Restoration or Reconciliation? Shifting Paradigms and Strategies for Conserving Threatened Wildlife in the San Francisco Estuary

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The salt marsh harvest mouse (SMHM; *Reithrodontomys raviventris*) is endemic to the marshes of the San Francisco Estuary, and is the only mammal entirely restricted to coastal wetlands. The loss of over 90% of tidal wetlands in the Estuary caused dramatic declines in populations of SMHM and other marsh-dwelling wildlife. The primary conservation strategy for the species, largely driven by acreage goals, has been tidal restoration (especially of diked managed wetlands) despite little empirical evidence in support. However, recent research has indicated that managed wetlands support SMHM populations as well as tidal wetlands do. Further, newer sea level rise models project drowning of tidal wetlands at an ever increasing rate. It has become clear to resource managers in the Estuary that tidal restoration in and of itself may not be a long-term, sustainable strategy for conservation of terrestrial marsh species. More important considerations, such as focusing on tidal restoration site selection rather than acreage goals, and considering alternate methods, such as maintaining some wetlands behind full or partial levees, may be critical in the future. Here we present data on the latest sea level rise projections, the state of habitat in the Estuary, and the most recent research on local endangered species, with a focus on SMHM to illustrate the challenges of creating habitat for an uncertain future. I will then present alternative strategies for conservation of these species in a rapidly disappearing ecosystem.

North Campus Open Space Restoration Project: A Sea Level Rise Adaptation Model

Lisa Stratton

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The 2018 restoration of the historic upper arms of Devereux Slough in Santa Barbara County models three climate change and sea level rise adaptation strategies for intermittently open estuary restoration projects. The project provides transgression space for salt marsh habitats that would have been lost in the unrestored slough; is designed to handle increasingly large storm events through increased capacity; and is modeled to convert to a fully tidal system after 1.5 feet of SLR which effectively lowers water levels by three feet. Transgression space is designed through gradual (100 to 50 to 1) slopes and through taking advantage of the opportunity to restore salt marsh at higher elevations (2 feet higher) in a portion of the project site where we found a higher water table. The benefit is that transgression space is immediately functional as the intended salt marsh habitat. Climate change is expected to increase rainfall intensity. The restoration project essentially doubled the size of the wetland basin, enhancing the capacity of the system to respond naturally and sustainably to intermittent storm events. Modeling indicates that, as sea level increases, the tidal prism expands into the restored system to the point that the basic hydrology shifts to a more open status, thereby eliminating the three-foot increase in high water levels created by the beach berm. This shift results from the mouth being maintained open longer by tidal currents, and has the additional benefit of reducing the future flood risk to adjacent residential areas.

Testing Novel Science-based Strategies to Improve Salt Marsh Restoration Success

Karen E. Tanner*, Ingrid M. Parker, and Kerstin Wasson

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The Stress Gradient Hypothesis predicts that plant-plant interactions will shift from negative under benign conditions to positive under stringent conditions. Although these predictions are well supported by work in natural systems, they have rarely been applied to improve restoration outcomes in abiotically stressful habitat. In coastal salt marsh, tidal inundation drives salinity and moisture gradients affecting plant performance, and these natural stressors can be exacerbated by coastal recontouring projects intended to buffer sea level rise. Studies clustering transplants together have demonstrated increases in seedling survival and growth at salt marsh restoration sites over the short term, but clustered plantings may experience stronger competition from neighbors as plants grow. We tested effects of clustering on two natives in the marsh-upland ecotone, *Frankenia salina* and *Jaumea carnosa.* Tight and loose neighbor arrangements spanned salinity and moisture gradients in the ecotone, where we tracked transplant survival, growth, and physiology. At our restoration site in central California, competitive interactions dominated in the marsh-upland ecotone. Neither salinity nor moisture gradients led to a shift from competition to facilitation for either species in this year of relatively mesic conditions. We found higher stem counts and greater percent cover of transplanted species in loose vs. tight neighbor plots, with more bare ground in tight neighbor plots. We also saw little difference in survival or tissue

water potential between neighbor treatments. Taken together, these results suggest that competition prevails at our site. Thus, rather than fostering positive interactions, tight clustering of plants enhanced competition and decreased restoration success.

ADAPT and THRIVE: Strategies for Life Along a Dynamic Coastline

Jennifer Zell, ASLA, RLA

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Long Beach faces significant risks from sea level rise (SLR). Increased flooding from changing precipitation patterns and an expanding ocean threatens significant industrial, transportation, commercial and civic infrastructure. Situated at the bottom of two major Southern California watersheds (the Los Angeles and San Gabriel Rivers), the water bodies emptying into San Pedro Bay are heavily polluted. This coastal zone is environmentally degraded, suffering the dual impacts of concentrations of heavy industry emissions and polluted runoff from an urbanized watershed, which stagnates nearshore trapped by the Long Beach breakwater. Responding to the changing climate and expanding ocean, ADAPT and THRIVE envisions a two-pronged approach to mitigation and adaptation measures to survive and thrive within the challenging environmental context and the dynamic nature of our Southern California coastlines. ADAPT and THRIVE grew from investigations into SLR impacts and collaboration with local scientists and an advanced landscape architecture studio at a local university. The stakes are high for climate change impacts on vulnerable human populations and other animal and plant species. Decades of hardening our coastlines with engineered coastal marine infrastructure has had a devastating effect on marine organisms including habitat loss and has encouraged development and investments along an unstable coastline requiring further hardening and defensive measures to protect. ADAPT and THRIVE envisions a living infrastructure that works with and enhances natural processes such as sediment deposit, bioaccumulation of material for strengthening, and biologically enhanced armoring units to provide shore stabilization.

Restoration of some of the most endangered ecosystems in the United States:

Grassland Ecosystems and Coastal Prairies

Chair: J.P. Marié, California Native Grasslands Association

Wed 10 April, 10:30am–1:50pm — *Oceanview Room*

Abstracts listed alphabetically by presenter (*)

Grazing to Benefit Endangered Ohlone Tiger Beetle at Glenwood Preserve

Lawrence Ford, PhD*[1], Richard Arnold, PhD[2], Devii R. Rao, MS[3], James W. Bartolome, PhD[4]

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Glenwood Open Space Preserve in Scotts Valley, CA, has successfully used livestock grazing and grazing lessee stewardship to optimize habitat quality for an endangered beetle. Established in 2001 as mitigation for a housing development, the 166-acre preserve improves habitat for the federally endangered Ohlone Tiger Beetle (OTB, *Cicindela ohlone*) on about 9 acres of grassland. Of the 17 sites that historically supported OTB in 1993, only 8 remain today. In one study (Arnold et al. 2012a), historical management played an important role in OTB persistence: current horse or cattle grazing was associated with most still-occupied sites, while all unoccupied sites had livestock grazing removed. A second study identified vegetation and bare soil conditions most associated with OTB occupation (Arnold et al. 2012b). At Glenwood Preserve, OTB population trends indicate grazing management has been effective (Arnold and Knisely 2018). Keys to optimize OTB habitat include identification of occupied habitat, and concentration or deferral of grazing on "special habitat" and "flexible use" fields. This optimizes grazing effects when annual grasses and forbs are growing rapidly and avoids excess grazing at other times. Incentives for collaboration with the local grazing lessee is critical to livestock availability on such small fragmented properties that depend on livestock to achieve conservation goals. Information from our studies and experience was synthesized into guidelines for habitat and livestock management for use by landowners to manage their properties to benefit the OTB in the periodically updated Long Term Management Plan (WRA et al. 2017) and Arnold et al. (2012a).

Can Functional Traits Inform Coastal Prairie Restoration?

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Restoration is riddled with unpredictable outcomes especially in a changing climate in which the extremity of droughts is likely to increase. This is compounded by a narrow focus on restoring certain species. At a coastal prairie at Younger Lagoon Reserve, Santa Cruz, I will determine whether drought-related functional traits of native and non-native species such as specific leaf area, leaf thickness, leaf carbon:nitrogen, and leaf δ13C carbon isotope signature, can explain the survival and growth of planted native plants. Twelve native species were planted in treatment types: shelter (60% natural rainfall reduction), control, and water addition (1/gal per week during the growing season the first year).

Are Populations of *Stipa pulchra* Adapted to Local Climates?

Madeline Nolan and Carla D'Antonio

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Over the last few decades restoration has been focused on the preservation of the local gene pool with most guidelines suggesting the use of locally sourced plant material. Preserving the local gene pool assumes that plants become locally adapted — a process by which natural selection in response to local environmental conditions allows resident populations to outperform foreign populations in their home environment. However, there remain significant problems with when and how to implement the practice in restoration projects. One problem with the practice of local seed sourcing, is the definition of "local" is ambiguous and not well-defined. A second problem is that using geographic distance could the reduce genetic diversity of populations. Genetic considerations are particularly important for dominant species within a restoration project, such as *Stipa pulchra* in restored California grasslands, because these species play a key role in structuring plant communities. Here we propose a series of three common garden experiments (Ventura County, Santa Barbara County, and Monterey County, CA) to confirm the presence of a home site advantage in *Stipa pulchra*. Preliminary results did not find evidence for home site advantage for any of the three local populations for any of the success metrics that we measured. These results suggest that alternative seed sourcing strategies, instead of local seed sourcing, could be used when restoring *Stipa pulchra* that could improve restoration outcomes.

Grassland Ecosystems and Coastal Prairies

Wed 10 April, 10:30am–1:50pm — *Oceanview Room*

Using Biocrusts as a Restoration Tool in Native Grasslands

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Biological soil crusts (biocrusts) play an important, yet often overlooked role, in ecosystem restoration. By changing the soil moisture, reducing erosion, and changing nutrient cycling, biocrusts are ecosystem engineers. This study looks at the methodology and implementation of biocrusts in grassland restoration. I place a special emphasis on restoring the native plant communities associated with the endangered Qunio Checkerspot butterfly, frequently observed on biocrusts in San Diego County. Over the course of three months, I grew biocrusts hydroponically in the greenhouse. I transferred these biocrusts to micro-scale plots to test how biocrusts affected the germination and emergence of native restoration species and emergent soil properties. Biocrusts were transferred to the field in February 2019, and results are forthcoming. Results of this project will lead to a large-scale biocrust restoration project in the Quino habitat. Additionally, in the coming months, I will be fine-tuning the greenhouse method to increase biocrust yield and water efficiency.

Lessons Learned from Milkweed Establishment Trials and Commercial Seed Production

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Establishment of milkweed (*Ascelpias* spp.) is a conservation strategy deployed to reverse the rapid decline of monarch butterflies (*Danaus plexippus plexippus*). In California, successful establishment of milkweed is challenging, and results mixed. Two of the most common techniques used to establish milkweed include direct seeding and installation of container stock. A narrowleaf milkweed (*A. fascicularis*) trial comparing two different seeding treatments and two different container sizes over a 2-year period was implemented. In Year 1, all treatments were weeded, irrigated and insect pests and diseases controlled. In Year 2, weeds were controlled at a diminished rate, irrigation significantly reduced on half the plots, discontinued entirely on the other half and insect pests and diseases control ceased. Informal narrow leaf milkweed and showy milkweed (*A. speciosa*) root masses trials were also implemented. Seeded areas tended to have greater foliage volume in Year 1 compared to container plants but container plants were of similar size by the end of Year 2. Foliage volume in Year 2 seeded areas was less than in Year 1. Foliage volume in plots with discontinued irrigation were similar to those with diminished irrigation. Establishment via root masses was low for narrowleaf milkweed and moderate for showy milkweed. Hedgerow Farms has successfully produced milkweed seed from several species, but intensive cultural inputs are required. The lessons learned from implementing milkweed seed production over several years provides useful background to inform milkweed establishment in non-production settings particularly when considered in combination with the results of the planting trials.

Field-fit Solutions For Vernal Pool Enhancement and Creation

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Vernal pool enhancement and creation is being implemented on MCAS Miramar in an area that supports a few scattered vernal pools. Central to success is site recontouring so as to optimize potential habitat diversity, species richness, and hydrologic function. Prior development of ground-penetrating radar data to determine depth to the confining clay layers and hardpan was beneficial. Starting from a conceptual restoration plan, the team conducted more detailed investigations to take into account microtopographic features, vegetation types, and sub surface claypan and hardpan depths. This resulted in a grading plan that reflected the true microtopographic site conditions, using a mix of conceptual, actual and interpolated data, allowing for flexibility in the location, size, and depth of the basins as they relate to site conditions. The implementation of this field-fit solution resulted in positioning and sizing the created vernal pools such that hydrologic function was optimized. Consideration for the proper function of the pool versus location in the landscape allowed pool creation to be seen as a dynamic process, fitting each pool to the actual site conditions. Final hand contouring of the pool slopes and bottoms added topographical features promoting a more complex biotic structure through structural patch richness. This hand grading also connected large and small pools together with directional swales and over-flow edges to accommodate larger rain events, a feature that is common in natural vernal pool complexes. Hydrologic function has proved to be excellent, and inoculation of the basins with propagules of protected plant and invertebrate taxa can proceed with confidence.

Opportunities to conserve and protect habitat:

Mitigation Banking, Land Use, and Conservation

Chair: Carol Presley, PE, Carol Presley Consultants

Thu 11 April, 10:30am–5pm — *Cabrillo Room*

Abstracts listed alphabetically by presenter (*)

Mitigation Banking: An Engine for Restoration

Andrew Cawley

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Mitigation and Conservation Banks are one of the largest land protection and restoration drivers in the United States. Between 1982—the year the first mitigation bank was established—and today, Banks have protected or restored over 800,000 acres of sensitive resources throughout the country. If combined, they would be the second largest national park in the United States. Importantly, Mitigation Banking is also a key sector within the $25 billion restoration economy, employing thousands of scientists, restoration practitioners, and entrepreneurs. Finally, as a market-based tool for restoration, it provides one of the most practical tools available today for bridging the gap between the desire to restore land and the ability to restore it. Drawing from regulatory data over the past three decades, industry expertise, and large-scale restoration case studies, this presentation establishes the importance of mitigation banking as a tool to accelerate the rate of ecological restoration and a method to finance a diverse array of restoration projects.

Design-Build and Design Intent: A Restoration Paradigm for Successful Stewardship

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San Felipe Creek runs through a former agricultural valley, but so do trails and roads serving public hikers, bikers, and equestrians. Humans shaped the landscape and are part of the ecosystem. How do we restore the landscape for humans and restore the natural resources that draw them there? As land stewards we asked ourselves these questions as we designed and built a 50-acre mitigation project for the Santa Clara Valley Habitat Plan. What started with a stream and watershed restoration vision quickly shifted. The ensuing rapid feasibility study revealed a complex site history, and a road as one of five tributaries to our stream. A field meeting with regulators at 35% design allowed us to explain site functions and values and how design elements would translate into credits—What were the impairments? What could be done to restore function and thus where should we focus? Early regulator collaboration and inclusion of road drainage improvements yielded compensatory mitigation credits for four permitting programs. Design elements were localized and diverse, and included restored wetlands, backwater channels, inset floodplains, gully plugs, staked wood jams, and graded swales. Advancing from 65% design to build allowed field-fit as plans became reality. The design-build approach and primary focus on design intent allowed for reuse of large wood on site, changing of geometries to preserve natural resources, and re-scaling built features to limit impacts. Following the design intent paradigm, the design-build team, including project partners, embraced their roles as stewards. Monitoring and adaptive management is underway.

Analyzing Historical Aerial Photographs and Vegetation Maps to Inform Conservation and Restoration at the Dangermond Preserve

Lucy Genua*, Meghan Bowen, Brad Anderson, Genelle Ives, and Kym Howo

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Conservation and restoration priorities can be informed by historical ecology, an interdisciplinary field that uses various forms of historical data to understand how ecosystems and landscapes have changed over time. Conservation and restoration planning is now underway at the recently established Jack and Laura Dangermond Preserve — 24,000 acres of coastal land in Santa Barbara County endowed to The Nature Conservancy in 2017. This study uses historical maps and aerial photographs to investigate how vegetation has changed on the property since the 1930s, during which time the land has been used for cattle ranching, climate has changed, and non-native species have been introduced. We used aerial photographs from 1938 and 2012 to identify vegetation as grassland, shrubland, or woodland at 340 random sample points within the preserve. Woodland and shrubland have become more prevalent over this time period, while grassland has decreased. Overall, there were net transitions from grassland to shrubland and from shrubland to woodland. We also compared the percent cover of vegetation types between a 1931 map from the Wieslander Vegetation Type Mapping (VTM) project and a recent CALVEG map. Coastal oak woodland and coastal sage

scrub have both increased in area, while grassland has decreased in area. These results suggest that the property has been a refuge for oak trees amidst statewide trends of oak loss. The Nature Conservancy should conserve oak woodlands and investigate opportunities for grassland restoration.

San Luis Rey Mitigation Bank — Reviewing a Riparian Restoration During Habitat Establishment

Mahala Guggino*[1], Cindy Tambini[1], Jeff Novak[1], and Ruben Ramirez[2]

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In 2015, Wildlands constructed a riparian and stream restoration project as part of the San Luis Rey Mitigation Bank (Bank). The stated purpose of the Bank is to rehabilitate, re-establish, and permanently protect approximately 54 acres of the San Luis Rey River and floodplain located in the City of Oceanside in San Diego County. The Bank provides compensatory mitigation for unavoidable impacts to jurisdictional riparian wetlands and streams and upland riparian habitat. Project goals included restoring self-sustaining fluvial processes and improving riparian and stream habitat for listed species including and arroyo toad, least Bell's vireo, and southwestern willow flycatcher. While the project has been driven by a regulatory-focused process, the restoration efforts are contributing to a resilient landscape. Ongoing monitoring shows that habitat establishment is on-target to achieve ecological restoration objectives and recruitment is abundant.

Implementing the National Seed Strategy for Mojave Desert Restoration

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Increasing large-scale wildfires, interacting with invasive species, along with expanding renewable energy development continue to negatively impact large acreages across the Mojave Desert Ecoregion. The National Seed Strategy for Rehabilitation and Restoration 2015-2020, details a comprehensive approach to putting the right seed in the right place at the right time for native plant restoration. The Mojave Desert Native Plant Program (MDNPP) is implementing the National Seed Strategy across the Mojave Desert Ecoregion, coordinating interagency efforts to prioritize restoration species, increase availability of Mojave Desert native plant materials, and improve success of restoration projects. Multi-faceted research supporting native plant restoration is underway to: 1) develop empiric seed transfer zones based on genetic analysis and common garden tests, 2) develop restoration decision-making tools for land managers, 3) develop seeding strategies to circumvent granivory on restoration sites, 4) develop Mojave Desert germplasm releases and species-specific growing techniques of use to commercial growers, and 5) increase availability of native plant materials for the Mojave Desert Ecoregion. A major emphasis of the MDNPP is restoration of habitat for the Federally threatened Mojave desert tortoise (*Gopherus agassizii*). Desert tortoise habitat has been heavily impacted by wildfires and subsequent annual brome infestations. Priority restoration species include those important for desert tortoise forage and cover, as well as species of value for pollinators.

Maximizing Mitigation on Public Lands: The Win-Win-Win, Roadblocks, and Solutions

Lindsay Teunis

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We will discuss the complexities of compensatory mitigation from a regulatory and restoration perspective and present new opportunities for partnerships between public and private entities. A large percentage of land in North America is under public ownership including federal, state, and local entities. The US Government owns 30% of the land in North America totaling more than 640 million acres operated by four entities, the BLM, Forest Service, Fish and Wildlife Service, and the National Parks System. In addition large swaths of public land are under state and local ownerships (counties and cities). Public land may often be in a depressed condition with little to no funding for long-term management much less active restoration. There are many challenges to facilitating mitigation on public lands and potential implications to the private mitigation market, however many types of projects have been successful including permittee-responsible projects, joint banking instruments, habitat conservation plans, and other crediting mechanisms. When successful, these partnerships can provide an influx of funding, facilitate the "big ideas," implement local conservation strategies, facilitate benefits to listed species and aquatic resources, provide efficiencies in regulatory permitting, and improve public lands. This presentation will focus on a series of issues and opportunities to implementing mitigation on public lands using case studies with a focus on discrete "roadblocks" with specific project experiences, solutions, and unresolved issues. Topics include protection mechanisms, in-perpetuity management/funds, land value, perceived gift of public funds, "hoarding" mitigation opportunities, changing policies.

Mitigation Banking, Land Use, and Conservation

Thu 11 April, 10:30am–5pm — *Cabrillo Room*

CDFW's Landscape Conservation and Planning Program Toolbox — Got New Tools?

Ron Unger

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California now has several conservation and mitigation tools for protecting the State's diverse biological resources, including the new Regional Conservation Investment Strategies (RCIS) Program (**https://www.wildlife.ca.gov/conservation/planning/regional-conservation**). This talk will provide an overview and comparison of several conservation and mitigation instruments administered by the California Department of Fish and Wildlife (CDFW), including conservation and mitigation banks, natural community conservation plans, and the new RCIS program. Determining which tool is better depends on several factors and biological diversity is not necessarily highest on the list even when it is a key driver of mitigation and conservation efforts. This talk will discuss some similarities, differences, pros and cons of these tools, and factors to consider when determining which tool to use to achieve mitigation of project impacts and conservation of ecological resources in your area. On September 22, 2016, the Governor signed Assembly Bill 2087 establishing the California Department of Fish and Wildlife's (CDFW) new RCIS Program. The RCIS Program enables voluntary, non-regulatory regional conservation strategies to guide comprehensive, cohesive, and connected regional conservation through philanthropic investments and advance mitigation. The RCIS Program has three components: regional conservation assessments (RCA), regional conservation investment strategies (RCIS), and mitigation credit agreements (MCA). The RCIS Program works with existing regional conservation plans and can fill in gaps in areas not covered by existing regional conservation plans. The RCIS Program uses a science-based approach to identify and prioritize conservation and habitat enhancement actions to help California's declining and vulnerable species by protecting, restoring, and reconnecting their habitats, and facilitating adaption and resilience to climate change, invasive species and other stressors. These actions may include land protection, habitat restoration, installation of wildlife crossings, removal of fish passage barriers, and other actions on private and public lands, including working lands. MCAs are based on the RCIS actions and provide credits on public and private

Mitigation Banking, Land Use, and Conservation

Thu 11 April, 10:30am–5pm — *Cabrillo Room*

lands that may be used as compensatory mitigation for impacts under the California Environmental Quality Act, the California Endangered Species Act, Lake and Streambed Alteration Program and potentially for federal mitigation requirements. NCCPs, conservation and mitigation banks, RCIS, and other mitigation and conservation tools may help regional planners and land managers by providing regional science-based conservation and mitigation plans or strategies, and by guiding investments to fulfill them.

Conserving Suburban Natural Areas — The Case of Rancho Del Paso

Tim Vendlinski

Independent consultant devoted to urban creeks, prairies, and forests; former supervisor of EPA's Wetlands Regulatory Program for Region 9; and former program director for the non-profit Sustainable Conservation **tvendlinski@sbcglobal.net**

A new global study has called for restoring and reconnecting small, isolated patches of habitat to safeguard biodiversity. How can we accomplish this feat in California where ominous economic, political, and social factors place ever-increasing stress on habitats already fragmented by agricultural conversion, and now degraded by suburban sprawl? This presentation considers the fate of the fabled, 44,000-acre Rancho Del Paso that has been erased from the landscape and public memory by subdivision, development, and the passage of time. Since 1980, activists have pressed for the protection of habitat within the heart of the erstwhile Rancho, and, so far, the City of Sacramento has designated ~100-acres of Natural Areas along Arcade Creek within Del Paso Regional Park. The Park supports a diversity of iconic flora and fauna, and remains a stronghold for resident and migratory birds. But there are no institutional arrangements to ensure the stewardship of these Natural Areas, and the City government remains the greatest threat to the Park's natural and cultural resources. If we cannot secure isolated patches of habitat amid publicly-owned parkland, how can we possibly do it elsewhere? This presentation profiles the modest scientific studies that profoundly impacted land-use decisions at the Park, itemizes a diversity of scientific research opportunities, and summarizes current conservation priorities. Come learn how people are leveraging science, policy, and law toward saving and restoring this small but remarkable place in the Sacramento Valley, and find out how you can help!

Markham Ravine Restoration — Early Implementation for the Placer County Conservation Plan

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The Placer County Conservation Plan (PCCP) has taken roughly 15 years of planning to develop and is about to be signed by Placer County, CA Department of Fish and Wildlife, US Fish and Wildlife Service, and US Army Corps of Engineers. The PCCP is to mitigate the impacts from development to endangered species, wetlands, agriculture and open space. As part of this plan, the County has approved an interim in-lieu fee program to be able to collect fees from developers to pay for mitigation in advance of the impacts. The 297-acre Markham Ravine project (Project), owned by Westervelt Ecological Services, is the first restoration project to be implemented for the PCCP. The Project re-contoured the existing irrigated pasture fields and re-connected the landscape to the floodplain. The restoration Project created vernal pool / swale complexes and seasonal / riparian wetlands along Markham Ravine. The Project follows the monitoring protocols for the PCCP and provides a long-term management plan for future stewardship, including managed grazing on the uplands.

Restoring Ecological Processes: Challenges with Uncertainty in Mitigation Banking

Ashley Zavagno

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As restoration ecology has evolved as a field, there has been an increased understanding of the importance of restoring ecological processes and not just habitat acreage. Projects aiming to restore ecological processes, however, can have significant uncertainty associated with amount of habitat ultimately restored, timing of recovery, and location of specific restored resources. This creates challenges for mitigation banks in defining and quantifying mitigation bank credits and establishing appropriate monitoring periods and performance standards. Modifications to existing natural resources that are sometimes necessary to restore ecological processes, such as filling incised stream channels or restoring tidal hydrology to seasonal wetlands formed on previously tidal diked lands, can create additional regulatory challenges in mitigation banking. WRA is exploring, and in some cases implementing, innovative strategies at several mitigation banks that facilitate process-oriented restoration while managing risk and uncertainty within the existing mitigation banking regulatory framework. Strategies and challenges will be discussed within the context of existing and pending mitigation banks.

Restoration and monitoring in a time of increased fire risk:

Restoration and Recovery after Fire and Debris Flows

Chair: Stacie Smith, NOAA Affiliate

Wed 10 April, 10:30am–12pm — *Santa Barbara Room*

Abstracts listed alphabetically by presenter (*)

Using Drones to Monitor Impacts and Recovery in Disturbed Ecosystems

Tom Bell*[1] and Andrew Brooks[2]

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In the early hours of January 9th, 2018, massive amounts of sediment and large woody debris associated with the Thomas fire flowed southward into the Carpinteria Salt Marsh via Santa Monica and Franklin Creeks. These materials partially filled the main channel connecting the two creeks with the Pacific Ocean and filled several of the smaller, tidal channels throughout the marsh. We collected imagery at several time points pre-and post-debris flow using a consumer-grade drone to quantify debris loads within the marsh and estimate the spatial extent of the accumulated debris material. Images collected at each time point were stitched together into a single, georeferenced orthomosaic using AgiSoft PhotoScan Pro. The resulting mosaics then were imported into Google Earth to enable comparisons between time periods and quantify changes in the spatial extent of debris at the cm scale. Comparison of images through time revealed 1) results of the large-scale dredging operations conducted in Franklin and Santa Monica Creeks, 2) large alterations in the direction of water flow through the marsh channels and 3) a surprising degree of recovery as several of the smaller tidal channels initially blocked by debris were cleared through the actions of tidal flushing. Our work has demonstrated that the use of inexpensive drones can provide an effective method of monitoring changes to natural systems over large spatial scales at cm level resolutions. Our plans include the use of drones to assess changes in marsh vegetation patterns resulting from altered tidal circulation patterns existing within the marsh.

Sustainable and Fire-Resistant Landscaping — Before and After Fire

Sabrina Drill, PhD

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Principles of fire-resistant, near-home landscaping include consider home design and materials along with plantings as a holistic approach to reducing ember-driven ignition; creating and maintaining defensible space; creating horizontal and vertical separation to disrupt flame continuity; and considering other fire-related risks, such as erosion and choosing plant material with fire resistant characteristics. SUSTAINABLE fire-resistant landscaping builds upon these principles with additional emphasis on incorporating water conservation, considering the support of habitat, and avoiding inputs and invasive plants that can impact the surrounding watershed. This talk will describe a successful outreach and education program, SAFE Landscapes, undertaken over the last decade, how to address the needs of those re-landscaping post-fire, and the incorporation of fire-resistant principles in the Ocean Friendly Gardens Program in Ventura, CA, in the wake of the Thomas Fire.

Southern California Steelhead Monitoring — Post Thomas Fire Challenges

Kyle Evans

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The Thomas Fire and subsequent debris flows have dramatically altered the landscape and significantly changed southern California's stream systems. Just over a year after the Thomas Fire we focus on the changes in stream habitat, water quality, and the new challenges moving forward while monitoring in post fire watersheds. Case studies from streams in Santa Barbara and Ventura county are used to examine changes in stream habitat characteristics with increased sedimentation, the limitations of DIDSON/ARIS sonar cameras, *O. mykiss* abundance, and CDFW's efforts to monitor recovery moving forward.

Fish, Fire, and Flows: Steelhead Recovery in the Santa Monica Bay

Rosi Dagit[1] and Tanessa Hartwig*[2]

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Federally endangered southern steelhead trout (*Oncorhynchus mykiss*) in the Santa Monica Bay are currently the southernmost breeding population, and therefore represent an important ecological link critical to recovery of the southern California Distinct Population Segment. Long-term monitoring of steelhead trout

provides a unique opportunity to examine the health and abundance of steelhead in the watersheds of the Santa Monica Bay after a prolonged drought (2012–2016) and several recent fires. Steelhead monitoring is also informing our creek and lagoon restoration alternatives and designs. However, prolonged drought and more severe and frequent wildfires are compromising streams with potential and current habitat, and therefore compromising the current steelhead population. The current state of watersheds in the Santa Monica Bay will be discussed. In addition, several restoration options, and their potential to positively impact steelhead, will be reviewed.

Backcountry Adventures to Inform Habitat Restoration

Denise Knapp* and Stephanie Calloway

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The Zaca and Jesusita Fires burned nearly 250,000 acres in the Los Padres National Forest Wilderness in 2007 and 2009. Invasive plants threaten the region's biodiversity, function, and resilience, and may be introduced from firefighting equipment or expanding in response to fire. We are conducting comprehensive rare and invasive plant surveys on all roads, maintained trails, and firebreaks on foot and mule-back to inform and prioritize habitat restoration. To date we have covered 590 miles, mapping a net 290 miles, over 279 people days. We have mapped 19 rare plant taxa in 230 polygons, and 18 invasive plant taxa in nearly 500 polygons. At least eight taxa are limited enough that eradication may be possible. This includes species on the California Invasive Plant Council's watch list and those that are not yet ranked. The center of the Zaca Fire scar is a rare plant refugium, and should be protected. More accessible trails nearer to cities were more heavily invaded, but also present an opportunity to engage the many volunteers that use these trails in habitat restoration. We made 24 seed collections for restoration purposes. Outreach is an important component of this project; thus far, we have reached over 30,000 people with our Facebook posts and videos, and 372 people via public presentations, about the beauty and value of this area, the threat of invasive plants, and more. By bringing the backcountry to the people, we can inspire them to protect and restore this rich natural resource in their extended backyard.

Interplay of riparian habitat, geomorphology, invasive species management, and fisheries health:

Stream and Fisheries Restoration

Chair: Ross Taylor, Ross Taylor & Associates

Wed 10 April, 10:30am–5pm — *Cabrillo Room*

Abstracts listed alphabetically by presenter (*)

Conservation Banking as a Tool for Riparian and Floodplain Restoration

Dan Chase*, Nate Bello, and Brian Bartell

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Conservation banking provides a unique opportunity for public and private partnerships to restore and protect riverine and floodplain systems that support threatened and endangered species of fish. Private land and capital can be directed towards the restoration of key habitat areas, with the design, ecological benefit, and long term monitoring standards reviewed and approved by public regulatory agencies. For protected species of fish, this can result in the connection and restoration of high quality riparian and floodplain habitat along important migratory and rearing corridors. Within Northern California's Butte Creek Watershed, conservation banking is being used to create and improve riparian and floodplain habitat in former agricultural fields. This location provides an optimal area of restoration for endangered winter-run and threatened spring-run Chinook salmon and steelhead, and presents a challenging balance to reach the desired habitat goals without adversely impacting flood control, private property access, and surrounding agriculture. Using established science and emerging conservation biology, restoration practitioners are working with public regulatory agencies and academics to understand and model the site's flooding and hydrologic dynamics to design riparian and floodplain habitat that will benefit juvenile salmonids. We present a case study on the modeling, assessment work, and conceptual design for restoring and enhancing rearing and migratory habitat used by protected salmonids and native fish. We provide a summary of the conservation banking concept and how this partnership provides a unique tool for the recovery of protected species that depend on riparian and floodplain habitats.

River Recovery Three Years After Removal of San Clemente Dam

Katherine Dudney*[1], Trish Chapman[2], Aman Gonzalez[3], Erin Seghesio[4], Steve McNeely[1], Seth Gentzler[1], Justin Sutton[5], Dylan Wade[5], and Shawn Chartrand[6]

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The Carmel River Reroute and San Clemente Dam Removal Project is a legacy project showcasing natural river recovery following removal of a 106-foot tall dam, relocation of over a million cubic yards of accumulated sediment, and restoration of historic riverine habitat. Three years following the dam removal, the restored river channel has significant native recruitment with absolute riparian vegetation cover of 60%. South-Central California Coast steelhead are migrating through the project reach, along with Pacific lamprey, which have never before been documented upstream of the dam. These successes follow winter storms in 2016/2017 that reconfigured the constructed channel and resulted in the need to reevaluate monitoring methods and performance metrics. The unanticipated movement of step pool boulders during 2-, 10-, and 30-year events provides opportunity to question the original channel design and construction, the fish passage criteria that drove the design, and expectations around long-term stability. In the presentation we will discuss lessons learned, including the importance of designing for natural channel evolution and developing design criteria and success metrics that are adaptable to changing site conditions. In conclusion, we will describe the revised, multi-faceted monitoring approach currently being implemented to assess fish passage and habitat, which considers both physical (e.g., geomorphology, hydrology) and biological (e.g., benthic invertebrates, fish counts, vegetation) data to make conclusions about the overall site recovery and project success.

Utilizing a Public-Private Partnership to Restore Native Fish Habitat in the Yolo Bypass: The Yolo Flyway Farms Restoration Project

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In conjunction with the California Department of Water Resources (DWR), Reynier Fund, LLC, ICF, and cbec Ecoengineering designed, permitted, and constructed a 278-acre tidal marsh restoration project in the Lower Yolo Bypass near the Cache Slough Complex to benefit native fish, including delta smelt (*Hypomesus transpacificus*) and winter- and spring-run salmonids. Yolo Flyway Farms represents the first project to be completed under a 2016 RFP released by DWR seeking complete 'turn key' tidal marsh restoration projects to partially fulfill mitigation obligations associated with the ongoing operation of the State Water Project, which delivers irrigation water to Central and Southern California. The design development and entitlement of each project is overseen by the multi-agency Fish Agency Strategy Team, or FAST, which is

tasked with approving mitigation for the ongoing need. The Yolo Flyway project was designed to take advantage of the large areas of the site that were at an ideal intertidal elevation for tidal marsh restoration that would contribute to the food web of the Cache Slough Complex quickly and without large amounts of earthwork. Construction of the project began in August 2018 and was completed in September 2018. DWR, in conjunction with the California Department of Fish and Wildlife, will begin collecting monitoring data at the site in 2019.

Los Angeles River Fish Passage and Habitat Structures

Wendy Katagi*[1], Nathan Holste[2], Michael Affeldt[3], and Eileen Alduenda[4]

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Stream and Fisheries Restoration

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The Los Angeles River in the project reach is a trapezoidal concrete channel. There is a low-flow notch along the channel center that is about 0.5 to 1 foot deep and has a top width of 20 feet. The channel was designed for a capacity of 80,000 to 100,000 cfs, yet the flow is less than 300 cfs about 90 percent of the time. Hydraulic modeling has demonstrated that current depth and velocity conditions are fish passage barriers at nearly all flows. Even at low flows, velocities are above the suitable range for native fish. Project objectives are to improve function of the LA River to increase biodiversity, enhance native fish habitat, and restore fish passage migration corridors to upper tributaries. The City of Los Angeles and project partners are working with multiple agencies to increase biodiversity and restore native fish habitat and fish passage migration corridors to upper tributaries with high intrinsic potential spawning and rearing habitat for steelhead and rainbow trout, arroyo chub, speckled dace, unarmored three-spined stickleback, and Santa Ana sucker. This native fish project is aligned with approved and ongoing plans for the Los Angeles River watershed and tributaries.

Watershed Restoration Strategies for Southern Steelhead Recovery on Gaviota Creek

Candice Meneghin

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Coastal Ranches Conservancy (CRC) is implementing a restoration program stretching from headwaters to the coast to support ecological resiliency and climate change adaptation on Gaviota Creek watershed. Watershed-level program objectives include: protecting headwaters, restoring fish passage, floodplain restoration, estuary enhancement, and are supported by a coalition of stakeholders. By purchasing conservation easements from willing sellers CRC is protecting Gaviota Creek from development and land use change impacts. Gaviota Creek's considered a Core 2 watershed in the Southern Steelhead Recovery Plan. Core 2 populations contribute to achieving recovery criteria within the Conception Coast Biogeographic Population Group (BPG). Gaviota Creek is especially important to the BPG, because of its year-round water supply — even during a seven-year drought. The construction of Highway 101 resulted in 17 fish passage barriers along Gaviota Creek. An alternatives analysis study is proceeding for the lower five fish passage barriers that have been identified as priority barriers by the Central Coast Fish Passage Advisory Committee. Additional efforts are pending to remediate the next six upstream barriers for removal. CRC has partnered with California State Parks to address the access road to Gaviota State Beach. The road cuts through the floodplain of Gaviota Creek, resulting in sediment accumulation upstream of the road crossing, forming an impoundment and fish passage barrier, and preventing sediment transport to the sea. Phase I will look at ways to restore passage, sediment transport, floodplain ecological processes, and support longer terms watershed goals of enhancing the estuary, which is 25% of its original extent.

Engaging Local Communities to Promote Urban Watershed Health & Understanding Around Salmonid Habitat Needs

Sarah Phillips

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The Urban Streams Coordination Program should be considered as a model to counties with an abundant number of watersheds interfacing with an urban environment. Since the Marin Resource Conservation District began its Urban Streams Coordination (USC) Program in late 2014, with funding through Marin County, over 2,000 residents in Marin County have been educated. It turns out that having a program dedicated to urban streams really pays off! Throughout the span of the USC Program, residents now count on the Program to support and guide them with their watershed stewardship curiosities, regulatory questions, and overall project support. The USC Program carries out the following activities: • Consults on proposed projects in order to promote soft engineering approaches such as laying back the banks and using biotechnical bank stabilization techniques with native plants as opposed to the traditional retaining walls or riprap installations; • Organizes and leads hands-on technical trainings, free for Marin residents, to teach them how to implement restoration actions on their own property and why it's critical for watershed health; • Provides free site evaluations for streamside residents that include issue-specific suggestions to guide the residents toward stewardship of their respected watersheds; • Assists in regulatory compliance for residents conducting restoration in order to incentivize residents to carry out more effective restoration projects; • Secures free or very low cost native plants to promote riparian revegetation in urban watersheds; • Serves as a communication liaison between local government departments, watershed groups, residents and regulatory agencies to promote better coordination on any and all restoration efforts and/or watershed issues; • Acts as a facilitator and mediator between multiple residents or regulators and residents to promote positive and productive relationships; • Creates incentives to promote watershed restoration on a parcel by parcel scale; • Secures grants and manages projects that install instream and off-channel habitat features for ESA-listed CCC coho salmon in the Lagunitas Creek watershed on private properties

Quiota Creek Restoration / Fish Passage — A Nearly Complete Watershed Plan

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A watershed plan was initiated in 2006 for the restoration of Quiota Creek, a tributary

of the Lower Santa Ynez River in Santa Barbara County and a NMFS-identified critical habitat stream for the recovery of the endangered Southern California Steelhead (*Oncorhynchus mykiss*). Drafting the Plan was a multi-stakeholder process that resulted in consensus from landowners, regulatory agencies, local government and the public that provided a road map for the extensive stream restoration efforts that followed. Twelve years later, nine of the eleven identified anthropogenic fish passage barriers within the watershed have been removed with one forthcoming in the fall of this year. The steps, design options, implementation success, and lessons learned will be presented in the context of fish passage, riparian habitat improvement, and connectivity of the aquatic ecosystem. Also addressed will be the importance of Quiota Creek in the ongoing monitoring and management efforts of the Santa Ynez River fishery for steelhead recovery.

Butano Creek Channel Reconnection and Resilience Project

Jai Singh*[1], Chris Hammersmark[1], Jim Robins[2], and Kellyx Nelson[3]

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This multi-objective project addresses critical fish passage, water quality and flood risk challenges affecting Butano Creek, Pescadero Marsh and the surrounding community of Pescadero in unincorporated San Mateo County. Anthropogenic disturbances to the watershed have significantly increased sediment delivery to Butano Creek and Pescadero Marsh. Along large portions of the project reach, sediment accumulation has filled the channel to the top of its banks. The resulting condition is nearly impassable for anadromous fish and other native fish species. These issues are of particular concern for populations of coho salmon and steelhead. Compounding these challenges are the regular development of anoxic conditions in the marsh which cause devastating annual fish fills in Pescadero Lagoon during natural breach events. The loss of Butano Creek's conveyance capacity also causes chronic flooding of Pescadero Creek Road, disconnecting the town from its main access route and emergency services following even moderate rain events. The upcoming project will excavate accumulated sediment from Butano Creek to reestablish fish passage between the estuary and the watershed and to reduce flooding of Pescadero Creek Road during frequent, low magnitude flood events. This sediment will be beneficially reused to selectively aggrade the marsh, filling in relic ditches, borrow pits and other man-made low spots that generate anoxic conditions and allow anoxic water to rapidly drain from the marsh into the lagoon following breach events. These actions will restore salmonid access to the watershed's spawning habitat and ameliorate the conditions that create anoxic water and drive fish kills.

Martin Slough Enhancement Project — Humboldt Bay, California

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Martin Slough is the lowermost tributary to Elk River via Swain Slough. The Elk River is an important anadromous salmonid watershed of Humboldt Bay and enters the bay south of Eureka, California. Martin Slough has a watershed area of approximately 5.4 square miles and natural channel length of over 10 miles, with approximately 7.5 miles of potential fish habitat. Focal species include Coho Salmon (*Oncorhynchus kisutch*), Chinook Salmon (*O. tshawytscha*), Tidewater

Goby (*Eucyclogobius newberryi*), steelhead (*O. mykiss*), and numerous other non-listed estuarine species. The lower portion of the watershed flows through low gradient bottomland containing the Eureka Municipal Golf Course and historic pastureland that is now managed by the Northcoast Regional Land Trust (NRLT). Historic impacts include extensive channelization, diking and draining of wetlands and side channels, and disruption of natural tidal function with tide gates. A multi-phase program to restore the lower reaches of Martin Slough has been ongoing since the initiation of a feasibility study in 2001. The on-the-ground work started with the installation of a muted tide gate in 2014 where Martin Slough enters Swain Slough. The Martin Slough Enhancement Project is located in and adjacent to the southern portion of the City of Eureka and terminates at its confluence with Swain Slough. Project objectives included flood reduction, restoration of tidal function and salt marsh habitats, fish passage and enhancement of fish habitat that focused on overwintering juvenile Coho Salmon and year-round Tidewater Goby habitat. During the 2018 construction season, approximately 4,200 feet of Martin Slough's main channel was excavated up the NRLT/golf course property boundary. Additional work included reconnecting a 2,000 foot long oxbow and its southeast tributary to Martin Slough's main and the construction of an off-channel pond. Monthly fisheries monitoring started on January 10, 2019 and confirmed that juvenile Coho Salmon were already utilizing newly created off-channel ponds and newly reconnected tributary channels. Tidewater Gobies were also captured in newly created habitats. PIT tagging of Coho and other salmonids will allow us to evaluate growth and movement through recaptures of previously tagged fish.

EcoFIP: Assessing Floodplain Inundation Potential for Salmonid Habitat

Luke Tillmann*, Josh Cumberland, and Chris Bowles

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California river systems have been extensively modified for flood protection, irrigation conveyance, transportation, sediment management, and other human activities, resulting in the creation of dams, levees, and other hydraulic structures that separate rivers from their historical floodplains. These modifications have dramatically reduced available rearing habitat for salmonids and contribute to their declining populations. In response, restoration activities have focused on reconnecting rivers with floodplain areas by levee setbacks and targeted levee breaching projects in an effort to remove hydraulic impediments to overbank inundation. Such projects involve detailed hydraulic modeling to assess grading designs for flood risk, inundation thresholds, and habitat suitability metrics, and locations are often determined based on the feasibility of land acquisition. To streamline the process of locating suitable areas for such projects, a tool called EcoFIP (Ecological Floodplain Inundation Potential) was updated to perform planning-level analyses based on hydraulic modeling to assess the quality of floodplain areas for salmonid rearing based on depth and velocity criteria, assuming hydraulic impediments were removed. A tiered approach was conducted to determine the level of effort and quality of results associated with both 1-D and 2-D hydraulic models and GIS post-processing analyses. Using the Feather River from Yuba City to the Sacramento River as a pilot reach, it was determined that, while a 2-dimensional model requires additional data inputs and more development time, it provided more realistic floodplain inundation dynamics and allowed for more complex suitability analyses for judging rearing habitat quantity and quality than its 1-dimensional counterpart.

Stream Restoration Design in an Anthropongenically Altered World

R.J. Van Sant*[1] and Michael Ladouceur[2]

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Restoration siting and design can be challenging in environments with anthropogenically altered landscapes including altered hydrology and sediment transport, urban encroachment, invasive species and changes to impervious surface. These challenges affect southern California and other large urban centers throughout the world. In such settings, restoring a site to historic conditions can often not be reasonably achieved, and although restoring to historical baseline may be thought of as the ideal scenario, an alternative approach is often required. Using a design approach that is informed by historic conditions while also acknowledging existing conditions and constraints is often the most suitable path forward. In addition to landscape constraints there are also regulatory requirements and hurdles that need to be met and overcome, including dealing with complex jurisdictional delineations, appropriate crediting, use of the watershed approach, defining and complying with self-sustainability requirements, and the use of artificial structures and other managed elements. This presentation will focus on the challenges of restoration and mitigation using project examples from work in the Santa Ana River (Riverside County), Otay River (San Diego County), and Coachella Valley (Riverside County). Project challenges and identified solutions for three real-world projects will be reviewed including: (1) river restoration in a severely truncated watershed with complex onsite constraints including utilities and border control; (2) tributary stream restoration in a highly urbanized environment with recreational uses, land-use constraints, and managed hydrology; and (3) restoration of desert wetland/ephemeral washes in a dense agricultural and recreational area with changing land uses.

Emerging tools for field work and data analysis:

Technology and Tools

Chair: Kari Dupler, WRA, Inc.

Thu 11 April, 10:30am–3:50pm — *Oceanview Room*

Abstracts listed alphabetically by presenter (*)

Climate-driven Vegetation Changes at the Dangermond Preserve: Implications for Restoration

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Climate change threatens an ever-increasing number of species with extinction. Large protected areas can mitigate biodiversity loss from climate change, allowing species to more easily track their preferred climate. However, the effects of climate change will alter the distribution of species within stationary protected areas, forcing managers to reassess conservation priorities. Modern technological tools can help land managers design realistic and resilient conservation plans to address this. Here maximum entropy (MaxEnt), a species distribution modelling program, is used to predict the future climate suitability for four plant species (a widely distributed native, a rare endemic, a northern species, and a southern species) at The Nature Conservancy's Jack & Laura Dangermond Preserve in Santa Barbara County. The predicted suitability for coast live oak (*Quercus agrifolia*), tanoak (*Notholithocarpus densiflora*), and La Purissima manzanita (*Arctostaphylos purissima*) are all reduced to different degrees under warming scenarios, but the coast live oak—the widely distributed species—showed evidence of resilience. In contrast, suitability will likely increase in the future at the preserve for the southern species, lemonade berry (*Rhus integrifolia*). Furthermore, by considering how climate stresses these species during their early-life stages, these results can be used to identify the most suitable locations for natural propagation, and thus better prioritize limited conservation resources. This study highlights how distribution modeling tools can be used to prioritize both locations and species for management action to maintain biodiversity and ecosystem function throughout California and beyond.

Walker Mine Tailings, Part 2: Utilizing Unmanned Aircraft Systems for Site Assessment

Samantha Birdsong* and Ian MacLeod*

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Following the previous talk by Ian MacLeod, here we discuss our use of unmanned aircraft systems (UAS, a.k.a. drone) to study the Walker Mine Tailings. We flew our recently-acquired DJI Phantom 4 Pro UAS with automated flight planning software at 80 m above ground level and collected 1,800 photos of the 100-acre site. We processed the photos into usable imagery using ESRI's Drone2Map software and analyzed the images in ArcGIS Pro. We produced the following products: a detailed high resolution orthomosaic image (with a pixel size of 1.8 cm vs. existing imagery at 60 cm); a topographic map; digital elevation models (DEM); and a 3D model. These UAS products have allowed us to more accurately delineate the site into multiple "habitat areas", classify ground and vegetative cover, and digitize trees to estimate tree density. The imagery also provides a permanent record that can facilitate long-term monitoring. In retrospect, we note the ease of actual flying (and the importance of pre-flight preparations) and the time-consuming nature of post-flight data processing.

UAV/RTK Data Collection for Aactive Construction Oversight and As-built Documentation

Sundaran Gillespie

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During the course of 2018, WRA implemented several large restoration projects across the state. All of these restoration projects have several agencies involved all providing high standards for success criteria. With over 20 different machines working at several sites, grade checking and oversight was set at a very fast pace. In order to save time in the field and to grade check larger swaths of area on the fly, WRA deployed several UAV flights in conjunction with RTK spot checks. With high accuracy RTK ground control points set in advance, UAV imagery was quickly processed day to day then spot checked throughout restoration areas to provide construction crews with up to date info on grade accuracy. Problem areas were then addressed and areas meeting goals were left intact. Finally after work was completed, one final UAV flight was performed to create the as-built conditions of each of the finished projects. These as-built datasets will provide the baseline for success criteria achievement in future years. Overall the combined approach of the UAV and RTK saved the clients and construction companies valuable time in order to meet their demanding deadlines.

Data Visualization Tool for Multidisciplinary Communication in Restoration

Seongjun Kim* and Mitch Swanson

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Technology and Tools

Thu 11 April, 10:30am–3:50pm — *Oceanview Room*

Implementation of a data visualization tool at the decision-making level can improve the communication and effectiveness within interdisciplinary restoration design committees. The restoration field is a unique intersection of several disciplines of sciences and engineering. Recently, for a large-scale bank protection project on 13.2 miles of the Lower American River (LAR), a large technical and resource advisory committee (TRAC) used an Excel Visual Basic Application (VBA) dashboard, that was developed by Northwest Hydraulic Consultants (NHC), as a data visualization tool to facilitate system-level discussion for design decisions. The dashboard is a customizable and interactive visual tool built in Excel to help experts understand connected, interdisciplinary effects of design alternatives. For example, a fish biologist can see to what degree changing water velocities can affect shear stress on the banks, while the hydraulic engineer can see how the grade of a bank may impact the habitat quality for Fall-run Chinook salmon. By using the dashboard, the TRAC selected from a menu of designs at each of the LAR restoration site segments of 0.1 to 0.7 miles in length. The TRAC members viewed cumulative effects on the reach, created their desired design combinations, and justified their selections for each segment. This unique approach gives more information and input to the stakeholders and clients. Their selections were shared, and a focused and productive discussion followed. With knowledgeable development and correct application, the dashboard has the potential to improve the communication within any multi-disciplinary project team.

Using Cloud-based Technology to Create Efficiency in Restoration Work

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Climate change, habitat destruction, and disappearing species are a call to action — let's use the best of our technology to make environmental work more efficient, to produce higher quality outcomes, and to streamline advancing the science, art, and practice of restoring native California habitats. Wildlands utilized Wildnote, a cloud-based platform, on the Sacramento River Ranch Mitigation Complex in Northern California, a restoration project that involves planting elderberry bushes and other trees naturally occurring in the same riparian environment. We will discuss the efficiencies obtained when tracking and counting 15 species of plants while documenting four different parameters (good, fair, poor and recruits) for each tree/shrub as well as shrub size information — we counted more than 2,000 trees and shrubs ranging across 52 plots. Wildlands also utilized this platform on the San Luis Rey Mitigation Bank, a wetland mitigation bank located near the City of Oceanside in San Diego County, California. The purpose of this mitigation bank is to rehabilitate, re-establish, and permanently protect approximately 54 acres of the San Luis Rey River and floodplain. Vegetation monitoring is a major component in measuring the function and performance of this major project. With 42 plots spread across the project, ranging from riparian, floodplain, wetland, to grassland, Wildlands will document all species along with cover values, height, and plant indicator status. Over the course of 2 years using Wildnote, Wildlands has counted over 12,000 native trees and shrubs and dozens of grasses and forbs across the 42 plots, saving effort, time, and money.

Walker Mine Tailings, Part 1: Revegetating Stubbornly Barren Tailings

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The Walker Mine, located in the mountains of Plumas County, CA, produced copper until 1941. The operation discarded the mine's sandy tailings up to 28 feet deep on a 100-acre meadow in the adjacent Plumas National Forest. Despite attempts to revegetate the site, the tailings remain largely devoid of vegetation, contaminate nearby streams with heavy metals, and produce hazardous airborne silica dust. We installed eight revegetation experiments from 2014–2017 to evaluate strategies for: (1) enhancing existing onsite vegetation, and (2) installing new plants. We sought to increase the water holding capacity of the tailings, increase organic matter and nutrients, and neutralize low pH we tested various amendments: compost, bentonite clay, superabsorbent polymer, slow release fertilizer, biochar, mineral soil (collected from nearby), limestone, and wood chip mulch. The existing, stunted plants responded well to mixtures of compost, clay, and fertilizer. Additionally, mineral soil provided native seeds and soil microfauna from the surrounding forests. For new plantings, we experimented with broadcast seeding and container plantings of trees, shrubs, and forbs. We were unable to irrigate our plantings and many new plants died during the first dry summer season but for those plants that survived, their health has continued to improve. Amendments such as compost, clay, and soil increased plant health and some plots now have populations of annual and perennial plants that are self-perpetuating by producing seed. In the next presentation, Samantha Birdsong will discuss our use of unmanned aircraft systems (UAS, a.k.a. drone) at the Walker Mine Tailings.

Using Plant Species Climate Tolerances and Climate Projections to Design Climate-Smart Riparian Restoration Projects

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An important step in some ecological restoration projects is selecting plant species that will accomplish project goals, are site adapted, and resilient to future conditions. Climate projections suggest that future

conditions may lead to shifts in plant ranges depending on species adaptive capacity, tolerances to climate variables, and other factors. To determine if a species may survive future climates, individual species' climate tolerances can be compared to future climate projections. Point Blue Conservation Science has developed a method to generate plant species climate tolerances and compare them to future climate scenarios in the 9 county San Francisco Bay Area, California. We use historic spatial temperature, precipitation, and climatic water deficit data and plant distribution from across California to assess species climate tolerances within the next 50 years. Species tolerances for an entire planting list are then visualized alongside future climate projections to determine restoration site suitability. A cross-validation analysis shows that these three climate variables combined have predictive value for species distributions within the Bay Area, and suggests that more extreme future climates could limit site suitability for some species. By including other species attributes like growth form, phenology, wildlife, and fire ecology this method can be used to create climate-smart planting palettes that can meet project goals.

Environmental DNA (eDNA) Use for Project Planning and Species Detection

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Restoration projects with potential to support protected species must consider these species at each stage in the process, from planning and permitting to implementation and performance monitoring. Traditional survey methods to detect protected species can be labor and time intensive and may not provide accurate results on species presence or absence. This is especially true for cryptic species (i.e. species that are morphologically similar) or when a species population abundance or density is low. Environmental DNA (eDNA) sampling technology has been around for years but only recently have the methods become cost competitive and more broadly utilized in aquatic and terrestrial environments. Sampling eDNA, when properly integrated, can greatly reduce field efforts and provide an additional level of confidence on species presence or absence at a site. Knowledge of species presence during design and permitting can be instrumental to an effective project especially if non-target protected species may be present and need consideration. This method can also be an effective way to supplement traditional survey methods by identifying focal areas when detection probability is low. In this presentation, we introduce eDNA and associated sampling methods, provide applications for its use, along with benefits and caveats of this method. We also offer two applications for using eDNA sampling: as a supplement to traditional survey methodologies during performance monitoring when species abundance is low (e.g. California tiger salamander, *Ambystoma californiense*), and for restoration planning with a cryptic species (e.g. giant gartersnake, *Thamnophis gigas*).

Restoration Project Information Management and Monitoring, Streamlined Web Interface

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To create efficiencies for internal and external data viewing for the Otay River Restoration project, and to help facilitate conversations internally as well as with resource agencies and project partners, ICF developed an open source online viewer as part of our new WayPoint technology platform. This customizable, user friendly website provides better management of historic and ongoing field data, such as map layers, photos, and drone imagery in one easy-to-access location accessible to all. Photos and video footage that might typically sit in folders and lack spatial context can now be accessed by simply clicking a point location on the map. Recent, high resolution drone imagery that can be difficult to share and even open without GIS software due to its size, is now available to all project partners. The ability to view photos, videos, and drone imagery over time lets managers observe construction progress from their desktop, and enables the tracking of vegetation growth and site maturation. The viewer provides version control by always depicting the latest project feature and mapped species data to all users, and a live connection to field survey data saves time and money by streamlining updates. Additionally, the project website comes equipped with our in-house commenting tools that let project partners share location specific observations or concerns. This website has been a key component to managing and sharing existing project data in a new and transparent way, and will provide the foundation for visualizing future monitoring efforts and comparing images over time.

Restoration in the future:

Thinking Outside the Box

Chair: Kevin MacKay, ICF

Thu 11 April, 2pm–5pm — *Oceanview Room*

Abstracts listed alphabetically by presenter (*)

Teaching Ecological Restoration to Future Generations

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Technological innovations in restoration ecology are continuously progressing, necessitating development in the pedagogy associated with teaching new concepts in the field. The practice of ecological restoration itself is also gaining recognition as a promising tool for teaching science concepts and for creating an important sense of stewardship for the land and meaningful relationships with the natural world for future generations. The Cheadle Center for Biodiversity and Ecological Restoration (CCBER) implements and manages numerous current and long-term restoration projects on the main UCSB campus and in adjacent areas. The close proximity of these sites to UCSB and the community provides unique opportunities for research, education, outreach, and public involvement. Educational services provided by CCBER include UCSB courses, seminars, workshops, interpretive media, and Kids in Nature (KIN), an award winning K-12 environmental education program. KIN is a yearlong, place-based program instructed by CCBER faculty and staff in which UCSB students develop new curriculum and mentor younger students through hands-on activities utilizing UCSB open spaces and involvement in restoration work. Through new approaches to education via ecological restoration, CCBER is able to profoundly impact the greater Santa Barbara community and beyond.

Open Meta-Analysis is a Reproducible Environmental Solution

Christopher Lortie

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Conservation decisions can reside with legislators or with environmental managers. To focus on the latter, managers typically have scientific backgrounds and routinely navigate the technical literature. However, engagement with scientific literature is non-trivial for all practitioners because of time, access, relevance of the science, and reporting standards. Environmental managers and conservationists need to be able to use evidence to inform decisions. However, there can be a gap in communication between basic science and management for at least three reasons. Firstly, the research is not a direct study of an ecosystem, and an immediate, real-world solution is needed by managers — preferably with a demonstrable outcome and reasonable cost estimate. This is a very real limitation in the primary science literature restoration ecology for instance. Secondly, the link between the biology or ecology present in the literature is not articulately connected to the similar process for the system at hand. Finally, the capacity to see the forest for the trees for even large-scale or broad basic research study can be a challenge. Science can be very specialized, and mobilizing knowledge for solutions requires both detailed expertise, scientific synthesis tools, or a focus on identifying the salient elements associated with a study. Often, seeing the forest also requires sampling many trees. This leads to the general proposal here that experts can promote reproducible and mobile knowledge for many fundamental scientific endeavors by considering use of scientific synthesis tools to inform solutions for the environmental crisis.

Speak to Be Remembered: Science Communication and the Art of Storytelling

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"We are, as a species, addicted to story. Even when the body goes to sleep, the mind stays up all night, telling itself stories."—Jonathan Gottschall

Have you ever tried explaining a basic ecological concept to someone and received a blank stare? Ever shared your work in a classroom and noticed a gaggle of glazed eyes? As ecologists and scientists the work we undertake is critical and core to the health of the environment (and humanity) — and yet, communicating about it in a way that is easily understood can be very difficult. The challenge is not in the information but in the communication. Research on brain processing has revealed fascinating details on why storytelling is one of the most powerful ways to communicate. Why is this, and how can we, as scientists, learn to incorporate the basics tenants of storytelling into the information we share? This session will explore the science behind storytelling, thoughts for how to improve the information we share, and examples of recent storytelling workshops that are being used to better understand the future of land stewardship.

How Phytophthora*, shot-hole borers, pine bark beetles, aquatic pests, and climate change impact landscapes*

Threats, Pests, and Pathogens

Chair: Ralph Vigil, Habitat Restoration Sciences

Wed 10 April, 2pm–5pm — *Oceanview Room*

Abstracts listed alphabetically by presenter (*)

Attempting to Eradicate *Limonium duriusculum* in Carpinteria Salt Marsh

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Channel Islands Restoration is working to eradicate a non-native invasive species, European Sea Lavender (*Limonium duriusculum*), from the Carpinteria Salt Marsh in order to restore habitat for three endangered species. These are Salt Marsh Bird's-Beak (*Chloropyron maritimum* ssp. *maritimum*), Crotch Bumble Bee (*Bombus crotchii*), Belding's Savannah Sparrow (*Passercullus sandwichensis beldingi*) and a suite of common estuary species. Eradication is proving to be a daunting task with approximately 4.7 acres of *Limonium* spread out over the 230-acre marsh. We will present our methods and results to date. This a collaborative project with the Upper Salinas-Las Tablas Resource Conservation District and the Wildlife Conservation Board.

Pest Monitoring — A Rapid Assessment Protocol

Chris Kallstrand*, Ryan Gilmore*, and Kam Muri*

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With new pests and disease entering California at an ever increased rate, the need for pest and disease monitoring in Southern California's riparian and oak woodlands has never been more important. Over the last several years, two pests in particular, Gold Spotted Oak Borer (GSOB) and Invasive Shot Hole Borer (ISHB), have increasingly presented a greater risk to woodlands, and have left land managers looking for treatment, tracking, and monitoring options. In order to treat a problem, one of the first steps is to determine what pest/s and/or diseases are present and determine how extensive the problem is in an efficient and rapid manner. To address the issue of rapidly identifying and assessing potential infestation areas, Rancho Mission Viejo along with Dudek have developed a rapid assessment protocol that was first implemented in 2014 as a way to quickly and efficiently identify potential GSOB and pest outbreaks. The rapid assessment protocol uses a three stage process; including aerial image review, vantage point reconnaissance, and field evaluations to located and evaluate potential pest outbreaks in southern Orange County. The program is in its 5th year of practice and continues to grow and evolve as an efficient means of rapidly assessing woodlands for potential pest and disease outbreaks.

IPM Building Blocks to Control Invasive Shot Hole Borers–*Fusarium* Dieback

Shannon C. Lynch*[1,3], Richard Stouthamer[2], Akif Eskalen[3], and Gregory S. Gilbert[1]

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The viability of oak and riparian communities in southern California is threatened by an emergent pest-disease complex involving two invasive shot hole borers (ISHB, *Euwallacea n. fornicatus*), each associated with specific fungal pathogens (*Fusarium euwallaceae* and *F. kuroshium)* that cause *Fusarium* dieback (FD) on 64 tree species. As part of a multi-campus and multi-agency collaborative effort, we are developing essential building blocks for integrative pest management (IPM) in native vegetation, urban forests, and avocado growing regions of California. The fundamental IPM components include 1) rapid early detection and identification tools; 2) identifying which habitats are most vulnerable to ISHB-FD and most important in its spread; 3) evaluating preventive and curative control options appropriate for different habitat types; 4) training users to identify ISHB symptoms and implement appropriate control measures; 5) evaluating and improving IPM strategies with managers in an iterative process. In the summers of 2017–2018 we measured vegetation and landscape characteristics, microclimate, and resident beneficial microorganisms across our network of 260 0.25-ha monitoring plots throughout infested and non-infested urban-wildland forests and avocado groves. Our preliminary data suggest that xylem-limited bacterial endophytes collected from healthy trees in diseased sites inhibit growth of the fusaria pathogens. Given that the beetles survive by feeding on their fungal symbionts exclusively, microbes interfering with fungal growth thus protect individual plants, potentially reduce disease spread, and present biocontrol opportunities. We are assessing their inhibition efficacy to determine which endophytes or combination of microbes to use for preventative and curative control experiments.

Threats, Pests, and Pathogens

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Implications of Unauthorized Human Uses on Riparian/Stream Restoration

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Humans use natural areas for authorized activities such as recreation, solitude, and education but also for many unauthorized uses including trails, off-road vehicles, dumping, illicit activities and homes. While authorized uses are factored into the land use planning and management of a space, unauthorized uses can have a wide range of detrimental effects on ecosystems, with a disproportionate impact on riparian habitats. We have observed unauthorized uses disrupting restoration and mitigation projects through direct disturbance of the restoration, increased implementation costs, and ultimately abandonment of sites due to failure to meet success standards, long-term ineffectiveness, as well as safety issues and liability. Unauthorized illegal human activities and subsequent impacts have been observed in most of the large urban river systems in Southern California including the Los Angeles, Ventura, San Luis Rey, San Diego, and Santa Ana Rivers, as well as many tributaries. This presentation will provide examples of projects that were substantially impacted by unauthorized uses at varying stages including, planning, implantation, and long-term management. Impacts, implications to the resources and applicants, and ultimate project outcomes will be discussed. In addition, the types of human disturbances that should be considered when selecting a site, evaluating risk, calculating short-term and long-term maintenance costs, setting success standards, and designing future management actions will be reviewed.

Evaluating Threats Posed by Exotic *Phytophthora* species to Sensitive Plant Communities in the Santa Clara Natural Community Conservation Plan Area

Tedmund J. Swiecki*[1], Elizabeth A. Bernhardt[1], Janell Hillman[2]

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This project focused on detecting *Phytophthora* species currently affecting or having the potential to seriously affect populations of covered plants in the Santa Clara Natural Community Conservation Plan (NCCP) area. A key component of the NCCP was the creation of a 19,000 ha reserve network within the plan area to safeguard protected and conserved species and habitats for the 50 year plan duration. We used a GIS-based analysis to identify at-risk priority habitat types within the reserve system that might be exposed to contamination from potential *Phytophthora* sources. We collected 189 root/soil samples from reserve system areas with high-priority vegetation types; 68 samples were collected from the three remaining populations of the endangered Coyote ceanothus (*Ceanothus ferrisiae*). Among terrestrial samples, Phytophthora species were recovered from 59% of periodically flooded sites, and 9% of samples of natural vegetation from drier upland and flat/lowland sites. *Phytophthora* species were also detected in 67% of 21 water samples collected across all locations. These included spring-fed ponds where contamination may have been introduced via grazing livestock. In all, 20 *Phytophthora* taxa were recovered, including several undescribed species. Most detected infestations were associated with common *Phytophthora* sources such as nursery stock plantings, previous agricultural areas, and contaminated watercourses. Spread from sources was associated with roads, trails, development and grading activities, and livestock grazing. One Coyote ceanothus population is threatened by an extensive but still localized, multispecies *Phytophthora* infestation that was likely initiated by a restoration planting of infected nursery stock.

Advancing Riparian and River Restoration in a Time of Uncertainty

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Restoration as a practice is built on the principle of change, with a primary goal of maximizing ecological processes to facilitate self-sustaining dynamic systems. Natural disturbances such as fire, drought, and flood play an important role in riparian ecosystems with many dominant species evolving aspects of their life history to complement such disturbances. However, natural disturbances have been modified by human actions with increased fire frequency/intensity, modified hydrology (e.g., dams and flood conveyance), and climate change. In addition to natural disturbances many stressors brought on by direct human actions further complicate restoration and subsequent management of riparian ecosystems. In southern California invasive plant and wildlife species are one of the primary stressors plaguing riparian areas. We will utilize two large-scale restoration projects currently in the planning phases to discuss a variety of current issues facing riparian restoration including the Polyphagous Shot Hole Borer (PSHB) beetle (*Euwallacea* sp.), water management (drought, dams, and conservation efforts), invasive plant species, and sensitive wildlife species. The first project is the Otay River Restoration Project where mitigation is proposed for the mainstem river approximately 1 mile below a dam. The second project is the Upper Santa Ana River Habitat Conservation Plan and Mitigation Bank located in Upper Santa Ana River Watershed, and includes restoration in the mainstem Santa Ana River floodplain and select tributaries. For both projects, discussions with resource agencies are focused on complex trade-offs regarding invasive species treatment, looming invasion by the PSHB, fire frequency, sensitive wildlife, and long term adaptive management.

How water conservation ripples through restoration, from landscape design to instream flows

Water Conservation for Improved Habitats

Chair: Jane Gray, Dudek

Thu 11 April, 2:20pm–5pm — *Santa Barbara Room*

Abstracts listed alphabetically by presenter (*)

Multiple Benefits of Riparian Restorations in California: Documenting, Communicating, Optimizing

Kristen Dybala*, Renée Cormier, Hilary Allen, Nathaniel E. Seavy, and Thomas Gardali

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Riparian restoration is an important strategy for providing multiple benefits to Californians, such as water quality, carbon storage, and biodiversity conservation. However, the actual benefits of individual riparian restoration projects are rarely documented, missing opportunities to communicate the full range of benefits, as well as opportunities to learn from these projects and optimize restoration design to simultaneously achieve multiple goals. First, we studied the carbon storage and biodiversity benefits of riparian restoration projects in the Cosumnes River Preserve in California's Central Valley to quantify the magnitude and rate of change in these benefits, and to understand how they relate to restoration design and management. We identified a synergy between carbon storage and biodiversity benefits in their positive associations with understory cover, but we also identified a trade-off in their relationships to forest stand density. Biomass carbon stocks were strongly positively related to stand density and bird density and diversity suffered at the highest stand densities, indicating opportunities to optimize riparian restoration design and management to achieve multiple goals. Currently, we are developing and testing a protocol for efficiently monitoring multiple benefits of riparian restoration projects in California. Preliminary data includes bird surveys, vegetation transects, and soil samples collected from three restorations projects in Marin County, California, ranging from 1 to over 20 years old. Broad-scale implementation of a multiple benefits protocol will allow better communication of the multiple benefits of riparian restoration efforts, and will contribute to improving the effectiveness of riparian restoration design and management in achieving multiple goals.

Panel: Water Conservation for Improved Habitats — How Water Conservation Ripples through Restoration from Landscape Design to Instream Flows

Jane Gray (facilitator)[1] with Steph Wald[2]and Dominic Roque[3]

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Water Conservation entails strategies, policies, regulations and actions aimed ensuring there is adequate water for humans and ecosystems. Land use is inexorably tied to water use and this panel discusses the ways we interact with water and how to make the best land use decisions to ensure water is equitably shared for flora, fauna and human consumption and landscapes.

Water Conservation Toolkits for Instream Flow Enhancement

Aja Bulla-Richards[1], Emily Corwin[1], Regina Hirsch*[1], Aimee Haasteaby[1], and Jordan Kear[2]

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Over-extraction, drought, and impervious development of watersheds have been identified by a major barrier to instream flows in coastal watersheds. Diminishing summer base flows are a barrier to fisheries habitat, water quality, as well as groundwater recharge. Recently, steps to prioritize projects to enhance instream flow on the Central Coast has been driven by efforts of Integrated Water Strategies (IWS) modeling through a Wildlife Conservation Board award 2018–2020. In conjunction with the modeled IWS prioritization, a subset of San Antonio watershed (Ojai City and the Sphere of Influence) has been quantified at the parcel level for local ecological water conservation and infiltration tools. The aggregation of these water conservation tools, combined with IWS prioritization, can inform a diverse portfolio of treatments significant to summer base flows for the San Antonio Watershed, as well as the Central Coast.

Using an Urban Runoff Source to Create a Thriving Wetland System

Barry Nerhus* and Luma Fowler

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After 10 years of implementing and managing a 40-acre riparian and wetlands restoration project, this site harbors two endangered and several rare species. Moreover, this wetland system utilizes

Water Conservation for Improved Habitats

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urban runoff to fill wetland ponds and channels. The system not only provides habitat, but also percolates water back into the water table. These ecosystem services are a solution to removing urban runoff from entering the ocean, providing rare habitat, and adding water to the ground water table. However, this system requires long term maintenance to abate mosquitos, monitor for new invasive species (shot hole borer), and protect from human impacts. The lessons learned from the 10 years of restoring, maintaining and monitoring will give insight to future projects.

Sustainable Groundwater Management and Restoration on Private Lands

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The passing of the Sustainable Groundwater Management Act (SGMA) in 2014 set a new mandate to balance groundwater use across the state. For parts of the San Joaquin Valley, home to much of the state's groundwater-dependent agriculture, doing so will require significant reductions in pumping and associated land-fallowing. Experts estimate that at least 500,000 acres of groundwater-irrigated land—10% of the current agricultural footprint in the San Joaquin Valley—will go out of production. If not properly managed, this sweeping land retirement will likely result in severe socioeconomic, community health, and ecological impacts. Environmental Defense Fund has adopted a multi-benefit resilience strategy to explore how this large-scale land conversion can be harnessed to create species habitat, provide alternative income for farmers, and improve environmental health conditions for local communities. Multi-benefit management, such as the creation of groundwater recharge ponds with wetland features and upland habitat restoration, can effectively balance over-drafted aquifers and offer an attractive alternative to traditional strategies for groundwater replenishment. EDF is using a multitiered approach to help facilitate the use of such methods, including the development of technical tools, legal assurances, and economic analyses to demonstrate efficacy and facilitate implementation. Working with San Joaquin Valley partners, EDF is ground-truthing these strategies in an effort to establish multi-benefit projects as a viable alternative to traditional land fallowing in response to SGMA.

Achieving Resilience at White Point Nature Preserve

Megan Wolff

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With multiple threats to our southern California ecosystems such as severe drought, wildfires, climate change urban runoff, and limited diversity in our plant communities, the Palos Verdes Peninsula Land Conservancy is working to achieve resilience through a series of habitat restoration projects at White Point Nature Preserve in San Pedro, California. At White Point, we are incorporating rare annual forbs, wildflowers, and bunch grasses to target biodiversity; local coastal sage scrub plant selections and federally endangered Palos Verdes blue butterfly host plants to promote fire resilience and at-risk species recovery; and enhancing bioswales to capture urban runoff and filter pollutants utilizing a community-based approach. This approach allows us to inspire the next generation of environmental stewards—our key to effective resilience over time.

Poster Session & Student Poster Competition

Chair: Elihu Gevirtz, Channel Islands Restoration

Reception: Wednesday 10 April, 5–7pm — *Santa Barbara Room*

Abstracts listed alphabetically by presenter (*).

*Presenters in **bold** are students who have received scholarships from the proceeds of last year's Raffle and this year's Student Scholarship sponsors*

Testing the Effects of Site Selection and Shelters on Restoration Seeding Success

Marlee L. Antill* and Erin J. Questad

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Slope and aspect are important factors in determining where native plant communities occur in seasonally dry climates and yet are underutilized in locating sites for restoration of native species in semiarid ecosystems. Habitat Suitability Modeling with Remote Sensing identifies high priority sites where abiotic conditions may be more favorable for native plant recruitment. High suitability sites (for example, north-facing, moderately-sloped areas) have been associated with native plant survival during restoration, possibly due to decreased moisture stress and seed movement, however these sites may not be accessible in all restoration projects. In regions where site selection is narrowed due to urban development and other restrictions, the use of artificial shelters may improve abiotic conditions for native plant restoration in low suitability sites. A two-year seedling survival experiment was established within a disturbed CSS habitat in southern California to test for differences in native plant recruitment in high and low suitability sites, both in and out of plastic tree shelters. Seeds of four common CSS species were sown directly in fenced plots, and survival and growth data were collected along with abiotic factors including solar radiation, soil moisture, and sediment erosion. Three out of four species showed increased germination, survival, and growth in high-suitability and shelter treatments. The use of shelters may also allow for chemical and/or mechanical treatment of weeds to occur simultaneously to native species addition, as the introduced plants are protected inside of a shelter. This could reduce the timing of restoration projects and help practitioners meet funding schedules.

Manual Removal and Herbicide Treatment for Maximum *Limonium ramosissimum* Reduction

Catherine Brett*, Patrick Yin, Anu Thirunarayanan, Zonghuan (Jason) Li, and Kyle Zhang

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Limonium ramosissimum, also known as Algerian sea lavender or LIRA, is a perennial herb native to the western Mediterranean. Introduced into the San Francisco Bay Area where it has proven invasive, LIRA has out-competed native plants. Initial herbicide treatments in the Estuary showed variable efficacy. Hand-removal efforts can achieve high LIRA mortality initially, but are more costly and time consuming. The purpose of this experiment is to determine whether manual removal in conjunction with herbicide treatment can shorten the time to local eradication. We investigated the impact of two levels of hand-removal effort after an herbicide application to determine treatment efficacy. All experimental plots were treated with herbicide, a mixture of glyphosate and imazapyr. Treatment 1 consisted of removing every LIRA plant, treatment 2 consisted of removing only the >15cm diameter LIRA plants, and treatment 3 was the control consisting of herbicide application only. Our results were inconclusive for treatment 2 compared to the control. Our results show that there is a statistically significant difference between treatment 1 and the control for LIRA percent coverage 6 months and 9 months after the treatment applications. This suggests that hand removal of every LIRA plant in conjunction with herbicide application is most effective at reducing LIRA percent coverage in the short-term. In most cases, however, herbicide use is likely preferable as it has similar efficacy as treatment 1 and is much more time and cost effective.

Fisheries Restoration Grant Program

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The Fisheries Restoration Grant Program (FRGP) provided more than $15 million annually for ecological restoration activities that help recover endangered salmonids. FRGP is an instrumental funding source in funding stream and fisheries restoration, water conservation restoration, and fire recovery restoration in California. We recently updated our application, review process, and timeline resulting increased restoration capacity. Local goverments, tribes and NGOs are eligible applicants.

Regenerating Soil Function on Non-vegetated Mine Wastes

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Mine-altered materials have a range of characteristics that are often atypical for soils and incompatible with plant growth. A systematic process of identifying growth limiting factors and treatments to correct them can regenerate soil function and support vegetative cover. It may not be natural, but it should be adequate to support native plant species that are most

compatible with local ecological conditions and adjacent communities. This presentation outlines a novel field treatment to add fines to coarse ore roast piles that are otherwise too droughty to support erosion resistant vegetation.

Pre-Planting to Preclude Persistent Pest Plants

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Managing invasive plants is a major component of natural ecosystem restoration. Dominant invasive plant establishment is a major stressor on tidal wetlands and may result in significant changes to native plant community structure and the potential decline of other organisms associated with these habitats. Tidal wetland restoration projects typically include initial invasive plant removal and rely on passive revegetation to facilitate native species recovery. Studies looking at active revegetation techniques in tidal wetlands to manage aquatic or semiaquatic invaders are scarce. Therefore, we are conducting active revegetation studies using dominant native aquatic plant species as a restoration technique in the SF Bay-Delta Estuary. The studies examine the planting success of four native species (*Schoenoplectus acutus*, *S. americanus*, *Persicaria amphibia*, and *Typha latifolia*) against two invasive plant species (*Phragmites australis* and *Ludwigia peploides*) at Bradmoor Island and Dutch Slough. Our hypothesis is using active revegetation with native plant species can effectively inhibit invasive plant species establishment. Implementation has been completed and we are currently in the monitoring phase of these studies. Potential implications include effective integrated invasive plant management on tidal wetland restoration sites for improved long-term restoration site function and decreased maintenance costs.

Determining Potential Drivers of Chaparral Conversion in a Southern California Fire Scar

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An increased fire frequency in southern California is thought to lead to the demise of chaparral with eventual type conversion

to grassland. Most studies supporting type conversion, however, have been limited in spatial and temporal scales. Here, we used historic aerial images from 1930 and 2009 to quantify chaparral conversion to sage scrub and grass within a discrete area of Ventura county (the 2003 Piru Fire scar) where fires have been common and chaparral predominated in 1930. Our analysis showed a persistence of chaparral despite many fires, and a higher transition of chaparral to sage scrub than to grassland. Sage scrub was dynamic, with approximately one third of what was present in 1930 converting to grass but an equal amount converting to chaparral. We used hierarchical partitioning analyses to determine which variables contributed most to conversion over the 79-year interval. Southwestness, distance from roads, and maximum January vapor pressure deficit (VPD) were shown to have the highest independent contribution in chaparral conversion with more southwest facing sites, closer to roads, and higher January VPDs showing the most conversion to sage scrub or grass. Conversion of sage scrub to grass was more likely if sites had a higher number of both short-interval (<10years) fires and number of fires since 1930. The observed vegetation fluxes in this analysis, suggest a step-wise process for chaparral conversion. The chaparral to sage scrub step appears primarily driven by winter site aridity, whereas the sage scrub to grass step appears largely driven by fire.

Supplemental Water Solutions for Threatened Santa Ana Sucker

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The heavily urbanized Santa Ana River (SAR) watershed comprises the largest river system in Southern California. Dams and increasing water demands have put pressure on endemic fish species, including the threatened Santa Ana sucker (*Catostomus santaanae*). The U.S. Fish and Wildlife's recovery strategy calls for active habitat restoration for the species. Upper SAR Tributary Restoration projects are being developed to restore and create high-quality habitat for the sucker. Four restoration sites have been selected near Riverside and will result in over 3 miles of enhanced/created channel and 50 acres of restored riparian habitat. Two tributaries are currently dry channels for most of the year and both pumped groundwater and treated wastewater have been proposed to provide perennial flows for the sucker. These alternative water sources are not unlike the Santa Ana River, which relies on treated wastewater for 77% of its total flow. The complicated hydrologic cycle of Southern California, involving sewage treatment and groundwater recharge, requires creative solutions for aquatic species recovery. This poster focuses on the design for Old Ranch Creek (ORC). Currently, ORC begins at a large storm drain and continues as an ephemeral creek before dissipating into a broad, undefined channel. Historically, the creek connected with the SAR until floods disturbed the confluence. This project will reconnect the creek to the SAR and receive pumped groundwater and/or treated wastewater to augment flows. 7,014 feet of channel enhancement/creation, in-stream habitat structures, and riparian restoration will provide habitat for the sucker.

Modeling Softwares: A Communication and Educative Tool for Dynamic Solutions to Complex Natural Systems

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Modeling software is a simulation machine used both for research and persuasive presentation of systemic behavior. A few examples in the ecological field include describing and analyzing watershed characteristics, determining the effects of variability in disturbance rates, and experimenting with the limiting factors of spatially explicit metapopulations. The user can safely test hypotheses or offer strategic predictions for ecological resilience by running scenarios using a variety of computer based interfaces. It is a great asset from land use planning, to proposing research to stakeholders, to facilitating education of environmental policy makers, ecologists and land conservationists. In order to regain, maintain, and conserve ecosystem functionality we must have quick access to solutions in an increasingly irregular climate. These softwares enable the simulation of ecological processes over a long period of time or costly large scale experiments within minutes thus, greatly increasing the efficiency of adaptive management. With creative storytelling from these validated results, land managers and educators can increase the stock of competent modelers and improve the dissemination of potential solutions in natural resource management. By having the software more readily available we can facilitate greater systemic understanding of how to decrease pressures on our natural systems in the academia as well as offer a profound lens that reaches an audience beyond the research sector.

Public-Private Collaboration for Land Preservation

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The Tri-Valley area (Dublin, Pleasanton and Livermore) has experienced rapid residential and commercial development growth in recent years, and this area currently lacks adequate wetland and species mitigation bank credits for impacts to these resources. Open space areas and grazing lands often support sensitive species or habitats, including federal and state-listed species. Sensitive biological resources may devalue a property for development, but can increase the conservation value. Public agencies may be able to maximize the value of their open space lands by creating mitigation turn-key projects, and selling conservation rights to a project proponent who needs to satisfy resource agency mitigation while retaining fee title. WRA, Inc., and the City of Livermore developed a public-private partnership to identify

conservation values on certain City-owned lands that support sensitive natural resources. The partnership then collaborates with Tri-Valley Conservancy as the easement and endowment holder to protect and manage the properties. The model provides mitigation opportunities for development projects in a region with limited mitigation options, financial incentive to the landowner, as well as funding for long-term management of the property. Two case studies where this model has proven successful are the Doolan Burrowing Owl Habitat Preservation and the Springtown Wetland Mitigation Project. The Doolan Canyon project preserved and enhanced approximately 200 acres of burrowing owl and California tiger salamander (state and federal threatened) habitat as mitigation for a development project. The Springtown project is a 40-acre alkali sink wetland complex with a variety of listed species that will be preserved as mitigation for development of an infill parcel in Dublin.

Post-fire Vegetation Mapping for Restoration Planning in the Angeles National Forest

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Across southern California, the coupled effects of fire, drought, and invasive species are reducing native plant populations and increasing destructive wildfires through type conversion of native shrublands to non-native, annual grasslands. Information on points of entry for invasive species is important to land managers yet difficult to assess over vast spatial and temporal ranges. Analyzing imaging spectroscopy data has been proposed to distinguish patterns in post-fire succession efficiently over large areas. A joint project involving Cal Poly Pomona (CPP), the NASA Jet Propulsion Lab, LA Audubon, and Environment for the Americas is utilizing maps created from hyperspectral data collected by AVIRIS to assess native habitats within two fire scars on the Angeles National Forest. To verify the accuracy of these maps, CPP students collected quantitative vegetation data in 2018. Rugged terrain necessitated a novel approach for ground data collection, combining field identification, quasi-aerial images, and an image analysis program to estimate cover within 100 plots. The field data will be used to assess accuracy of remote sensing maps, and to perform community composition and resilience analyses based on topography, time since fire, and other factors important to ecologists.

Introduction to Ecology in South Central Los Angeles

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Many residents of urban Southern California have little understanding of the impact that ecology has on their daily lives. Human development throughout the state, especially along the coast, has led to unprecedented levels of pollution as well as the fragmentation of many ecosystems. Urban areas are sometimes excluded in public education programs simply because of their perceived lack of relevancy, despite these areas being home to much of the city's population. By engaging with elementary school students and explaining the current and future impacts human behavior has on the environment, we can nurture a respect for the world around us while inspiring future generations of ecological restorationists. This will also motivate grassroots restoration efforts by the local community. The students of Raymond Avenue Elementary have generously provided a space for the creation of a small native garden. The garden will serve as a means to attract pollinators to the spot. The students will be instructed in proper planting techniques and watering techniques to maintain the garden. They will also be taught how to identify the native plants and insects that can be found in the garden. This garden will provide a hands-on opportunity for the kids to interact with the natural world. It will provide the students with an introduction to the native flowers and insects of Southern California as well as a basic understanding of the ecological services of plants native to the area, while at the same time working to reverse habitat fragmentation.

Soil Solarization for Restoration Site Preparation without Herbicides

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Irvine Ranch Conservancy (IRC) is exploring techniques for restoration site preparation that do not involve herbicides. Solarization is a technique for eliminating weed seeds and other pests from the soil using high heat and humidity. It involves irrigating the soil and covering it with a layer of clear, UV-resistant plastic for several weeks during the summer. IRC used this approach to restore approximately 300 square meters of highly degraded habitat at Bommer Canyon in the City of Irvine Open Space Preserve during July and August 2018. At the beginning of the experiment, these sites were dominated by a mix of non-native grasses (*Bromus* and *Avena* species) and forbs (*Brassica*, *Sonchus*, and *Erodium* species). After completion of solarization, the plots were direct seeded with native shrub, forb, and grass species in late November 2018. Weed seedbank depletion was assessed in March 2019 using quadrats to measure density and cover of seedlings within solarized and adjacent non-solarized control plots. Solarization completely eliminated non-native grasses from the soil and caused 80 percent reduction in density of broadleaf weeds. Despite the reduced weed seedling density, the surviving broadleaf weeds attained a cover comparable to that of the control plots. However, manual removal of weeds was relatively easy due to reduced numbers. Solarization is an effective

procedure for quickly restoring a site without the need for a multi-year site preparation phase. It should be considered where local ordinances prohibit herbicide use. However, since it is a resource- and labor-intensive process, it is best suited to small, level, highly visible sites.

Evaluating and Prioritizing Sequoia and Kings Canyon's Wilderness Meadows for Restoration

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Sierra Nevada meadows store snowmelt and maintain shallow groundwater year-round in a climate with little summer rainfall. As a result, mountain meadows are highly productive, biologically diverse, and are among the most valued mountain ecosystems. Many meadows are also natural floodplains, but they have been degraded by erosion and channel incision, resulting in decreased water availability, productivity, and biodiversity. As the warming climate makes snowpack a less reliable source of stream flow in summer, water resource managers and conservationists are looking to meadow restoration as a tool to increase watershed resilience and preserve summertime stream flow. American Rivers partnered with Sequoia and Kings Canyon National Parks to assess 60 backcountry meadows with the goal of identifying restoration priorities to improve habitat and increase groundwater storage. We focused our efforts where the Soil and Moisture Conservation Crew had previously attempted restoration work, mostly in meadows that were historically grazed. We used historic imagery and American River's Meadow Condition Scorecard to identify meadows in need of restoration. Observed adverse impacts included incised stream channels, headcuts, gullies, and encroaching conifers. We identified 35 meadows that show project potential because of these impacts. Gullies and headcuts are the most frequent impact across our assessments and conifer encroachment is correlated with these impacts. The next phase of the project will include prioritizing wilderness meadows for restoration and piloting wilderness-appropriate restoration techniques in Sequoia National Park.

Death to The Monarchs: A Not So Tropical Vacation

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Monarch butterflies that migrate from the west and overwinter in areas on the coast of California are facing two secondary threats: 1) introduction of the invasive non-native Tropical milkweed (*Asclepias curassavica*); and 2) a protozoan parasite of monarch butterflies (*Ophryocystis elektroscirrha* or OE for short). Milkweeds of the genus Asclepias are the host plants for the monarch butterfly and without them, the larva would not be able to fully develop. However, when planted in unfamiliar climates, are unsafe. In California, the demand for Tropical milkweed has skyrocketed due to its affordability, aesthetically pleasing appearance, simple propagation, and ability to thrive throughout fall and winter. Because California is a much warmer environment, the tropical milkweed does not die back in the winter like the natives. This is causing the monarchs to end their migration pattern and stay where the food is, increasing the threat of OE. OE travels with the monarchs when they migrate and is deposited on the leaves of native milkweeds but dies once the milkweeds die back in the winter. Unfortunately, because tropical milkweed does not die back, the OE levels increase and monarch caterpillars feeding off the plant become exposed. OE impacts the monarchs by disrupting their lifecycle, breeding habitat, and lifespan. Ways to reduce the dying monarch population and spread of tropical milkweed are: 1) planting milkweeds only native to California; 2) removing tropical milkweed, replacing it with natives; 3) research plants before purchasing them; and 4) incorporating native milkweeds in future restoration plans.

Ampithoe valida Grazing on San Francisco Bay's Various Seagrass Meadows

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Seagrass has a variety of beneficial roles in aquatic environments ranging from decreasing high-tide speed, sediment and nutrition filtration, and providing a nutritive habitat for marine life. Currently, the grazing effects of *Ampithoe valida*, an invasive amphipod species found in San Francisco's Tomales Bay, are lowering the density of San Francisco's seagrass, *Zostera marina*, and thereby potentially impacting the marine ecology of surrounding meadows. To better understand *Ampithoe valida*'s effects on the surrounding ecosystem, we aimed to measure which species of seagrass *Ampithoe valida* preferred, as well as *Ampithoe valida*'s rate of consumption. When presented with seagrass from three different Tomales Bay sites, the northern and southern seagrass had a statistically significant consumption rate, higher than the seagrass geographically in-between. In contrast, when only provided one seagrass type, the invasive amphipod species consumed more of the geographically middle seagrass. Given the northernmost site is a colder, aquatic region, while the southernmost is a warmer, inland region, we hypothesized the seagrasses may have adjusted their nutritive content to adjust to the various temperature and environmental differences. In addition, the middle site may have a nearby freshwater runoff which could also affect its nutrient content, thereby requiring a higher consumption rate for metabolic stabilization. Given this species is only found to exist in the warmer, inland area of Tomales Bay, further experimentation can be conducted to infer the mechanisms causing the species' varied affinity.

Local Grassland Restoration Affects Insect Communities

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We hypothesize that ecological restoration in grasslands can induce an alternative stable state shift in vegetation. The change in vegetation influences insect community assemblages and allows for greater functional redundancy in pollination and refuge for native insect species. Functional groups are defined by insect feeding habits; greater functional redundancy would indicate greater species richness within the functional group. We evaluated the insect communities at eight coastal California grassland sites. Half of these sites had undergone restoration through active revegetation of native grassland flora and half were non-restored. Insects were collected from *Lupinus bicolor* (Fabaceae) within 2 × 2-m2 plots in spring 2017. We found that insect communities were different between restored and non-restored sites. These differences were seen in insect functional groups as well as differences in insect community assemblages which were found to be driven by environmental characteristics such as non-native forb cover. Functional redundancy of herbivores decreased at restored sites while pollinators became more redundant compared to non-restored sites. The assemblages of the common species found at restoration sites contained a greater species richness of native insects than those found at non-restored sites, including species such as *Bombus vosnesenskii*. We recommend that restoration practitioners consider the utility of their restoration for native bumblebees and potentially use it as justification to request funding for facilitating insect conservation within ecological restoration.

Bark Beetle Mycobiome: An International Coordination Group Advancing Bark Beetle Symbiosis Research

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Bark beetles have evolved symbioses with fungi and their tree hosts that range from highly specific, to loose associations, to asymmetrical dependence. Besides the potential to be on the cutting edge of symbiosis research, the beetle-fungus relationship is hugely destructive, with outbreaks and epidemics reaching record proportions in forests on every continent, costing billions of dollars per year. The scientific community trying to understand and mitigate these emerging global threats is facing a critical shortage of expertise, large public datasets, updated research methods and standards, and knowledge flow systems that connect a global community of forest entomologists and pathologists. These challenges result in the use of incomplete information by end-users who make important policy decisions concerning international biosecurity, trade, and natural resources protection.

Shrubland Restoration in Southern California via Seedbank, Seed, and Seedling Transplants

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Shrublands in California have many ecosystem values and are becoming increasingly degraded, yet only a handful of studies have been published on attempts to restore them. Here, we present information on efforts to restore species from both community types into a degraded shrubland site within the Piru Fire scar in Ventura County, California. The site has evidence of past chaparral shrubs (i.e., large burnt stumps) but is now dominated by exotic grasses (e.g., *Bromus* spp.) and forbs (e.g., *Erodium* spp.) with scattered sage scrub shrubs (e.g., *Salvia leucophylla*). We tested three field approaches to restore composition: (1) stimulating the seed bank, (2) hand broadcasting seeds, and (3) transplanting 3-4-month-old seedlings. Competition with exotic annuals was controlled at: no removal, half removal (seedling treatment only) or full removal. To stimulate the seedbank, we scarified the soil to 5 cm. Native annual forbs, including many fire followers, germinated from the seedbank with greater diversity where competition was controlled. For approaches (2) and (3), we focused on establishing *S. leucophylla*, *S. apiana*, *Malacothamnus fasciculatus*, *Hesperoyucca whipplei*, and *Eriodictyon crassifolium*. We sowed 220 seeds/m2 and transplanted 6-7 seedlings/m2. Three seeds germinated and survived in the seeding trials. *Salvia apiana* seeds and seedlings had the highest rate of establishment, followed by *S. leucophylla* and *M. fasciculatus*. Transplant survival was positively correlated with competition removal. These results highlight the successes and constraints of restorative activities in the wildlands of southern California and offer directions to efficiently address the constraints with the aim of increasing overall shrub establishment.

If We Build It, Will the Southwestern Pond Turtles Come?

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El Estero Drain, an earthen bottom linear channel, is in an urban environment adjacent to El Estero Wastewater Treatment Plant and the Southern Pacific Railroad. The southwestern pond turtle has been documented in the segment of Laguna Channel between Yanonali Street and Cabrillo Boulevard possibly supporting the only natural breeding population for the southwestern pond turtle in the City of Santa Barbara limits. El Estero Drain is situated nearly perpendicular to Laguna Channel and connects with the channel just north of the Union Pacific Railroad overpass and Chase Palm Park. Issues with the El Estero Drain included being choked by non-native invasive vegetation, contaminated soils, improper water conveyance sloping and fragmented habitat from the adjacent Laguna Channel. The City of Santa Barbara worked with permitting agencies and contractors to prioritize soil remediation and restoration of native habitat to give southwestern pond turtles assess to habitat and provide basking sites. This was accomplished by constructing a turtle ramp to eliminate the one foot vertical drop between Laguna Channel and El Estero Drain, installing ponds, basking sites, and native plants to provide riparian cover, upland nesting habitat, and open water habitat. Dudek is performing long-term native habitat restoration monitoring to document the success of native plant establishment and the southwestern pond turtle. Now that the native habitat has been restored, the question is: will the southwestern pond turtles come?

Regional Conservation Investment Strategies Program: A New Conservation Tool

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On September 22, 2016, Governor Brown signed Assembly Bill 2087, establishing the California Department of Fish and Wildlife's (CDFW) Regional Conservation Investment Strategies (RCIS) Program. The RCIS Program enables development of regional conservation strategies to identify opportunities for philanthropic investments and advance mitigation that would result in effective regional conservation. The RCIS Program promotes the use of existing science to identify and prioritize region-specific conservation actions to help California's declining and vulnerable species by encouraging the protection, restoration, and reconnection of their habitats, and facilitating adaption and resilience to climate change, invasive species, and other stressors. These actions may include land

protection, habitat restoration, installation of wildlife crossings, and removal of fish passage barriers. The RCIS Program consists of three components: Regional Conservation Assessments (RCAs), Regional Conservation Investment Strategies (RCISs), and Mitigation Credit Agreements (MCAs). Strategies are developed in an RCIS and actions may be carried out through an MCA, which creates credits to be used as compensatory mitigation for impacts under state and federal laws. This poster will further explain each of the Program component's benefits and uses in relation to conservation and recovery of sensitive species and how the Program relates to other CDFW conservation planning instruments.

Captive Propagation and Reintroduction of Large-flowered Fiddleneck (*Amsinckia grandiflora*)

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A team of botanists and horticulturists from Vollmar Natural Lands Consulting, the University of California Botanical Garden, and Planet Horticulture has received a grant from the Central Valley Project Conservation Program to reintroduce large-flowered fiddleneck (*Amsinckia grandiflora*) into its historical range. This federally and State-endangered annual wildflower is known from only one extant natural population, located in southwestern San Joaquin County. The species is associated with grassland habitats with fairly neutral, rich, clay loam soils, and it therefore suffers from competition with introduced annual grasses that thrive in such habitats. It is also a relatively tall species that features shallow roots, and its affinity for excessively steep slopes increases its susceptibility to trampling and soil erosion by livestock. As such, large-flowered fiddleneck is emblematic of the vulnerability of native grassland forbs to historical and ongoing habitat change as well as habitat management. The current reintroduction effort is showing some promise, thanks to the availability of modern spatial analysis tools as well as increasing scientific documentation on the benefits and drawbacks of livestock grazing. The use of sophisticated GIS software to analyze high-resolution data has enabled the development of a precise habitat model, which in turn has facilitated the identification of optimal reintroduction sites. Additionally, strategic grazing regimes are being employed to reduce introduced grasses without the associated trampling or erosion. By refining the reintroduction methods for an extremely rare and highly vulnerable grassland species, the team seeks to more generally improve methods for reintroducing and sustaining rare grassland plant species.

Climate Change Vulnerability Assessment of Island Oak (*Quercus tomentella*)

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Island oak (Quercus tomentella) is a rare oak species endemic to six islands in the California Island Archipelago (CAIA). Over a century of farming and grazing on the islands degraded core habitat and reduced island oak seedling recruitment. The species was listed as endangered by the IUCN in 2016. Most historical threats have been removed, though island oak regeneration is still restricted and there is concern that impending climate change poses an additional threat that may ultimately lead to extinction. Spatially-constrained, if the island oak's range shifts or further deteriorates, alternative options are limited. We used MaxEnt, a species distribution model, to identify island oak's bioclimatic niche on Santa Cruz, Santa Rosa, and Santa Catalina Islands and then predicted where that niche would exist through the end of the century, under four climate change scenarios. Model outputs supported three main findings: (1) Island oak's predicted bioclimatic niche was largely driven by soil moisture availability; (2) Santa Rosa Island had the most predicted suitable habitat under each climate change scenario, while predicted suitable habitat on Santa Cruz and Santa Catalina Islands was minimal; and (3) the bioclimatic habitat occupied by island oak varies substantially between the three islands studied. Improvements in life history information, legacy grazing patterns, and more finely downscaled climate data would substantially increase model validity. Research should focus on identifying mechanisms driving the variation in habitat occupied on each island, while restoration should prioritize habitat augmentation and seedling recruitment, to increase island oak's resiliency to climate change.

Golf Courses as Sites for Ecological Restoration in California Communities

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Golf courses, although often overlooked, are opportune spaces for professional ecological restorations efforts to facilitate the recovery of native California habitats. Beyond recreational opportunities, golf courses provide community-wide environmental benefits, such as capturing stormwater runoff, providing wildlife habitat, sequestering carbon, and relieving urban heat island effects. Golf course superintendents are professional stewards of the land and are interested in promoting multi-functional landscapes with high ecological significance. With increasing climatic and social pressures, golf course superintendents are seeking methods that reduce overall inputs required to maintain their landscapes. One approach to these needs is incorporating natural areas, like grasslands and native habitats, into roughs and out-of-play areas. Yet, natural area establishment and maintenance on golf

courses brings unique challenges like managing playability, irrigation with recycled water, and converging needs of diverse stakeholders, who value and utilize these spaces in different ways (e.g. as competitive sport spaces, event venues, community green spaces). Golf course facilities can also serve as sites for public engagement around environmental and social benefits of restoring native habitats. Golf course superintendents often turn to professional associations, golf course architects, seed distributors, and other allied golf industries for guidance in their ecological restoration decisions. There is an opportunity for ecological restoration professionals to expand and enhance natural area establishment and maintenance at golf course facilities. Done well, the efforts may result in 1) improved land management practices to protect California's natural resources, and 2) promotion of community health and wellness.

Oak Tree Restoration at Lake Cachuma, CA

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In 2004, the Cachuma Operation and Maintenance Board completed a project at Bradbury Dam to raise Lake Cachuma (located in southern Santa Barbara County, CA) by three feet during surcharge events. The additional stored water is in support of the endangered Southern California Steelhead (*Oncorhynchus mykiss*) downstream of the dam in the Santa Ynez River for fish passage supplementation and dry season rearing flow releases. By raising the lake, 879 *Quercus agrifolia* (Coast Live Oaks) and *Q. lobata* (Valley Oaks) were initially killed by the rising waters and another 1,405 oaks were determined to be at-risk. The 2,284 impacted oaks were required to be mitigated in rural open areas around the lake at a two-to-one ratio totaling 4,568 self-sustaining trees by 2025. This poster describes the mitigation process that begun in 2005, the annual tree planting effort and results, survival rate, routine maintenance, costs, program challenges, and lessons learned from 2005 to 2017, as well as projections to 2025. This is an excellent example of a fisheries restoration project that had a byproduct of an extensive habitat restoration effort.

Endangered *Suaeda californica* Reproduction and its Use in Sea Level Rise Adaptation in San Francisco Bay

Kelly Santos*, Melissa Patten, Peter Baye, and Katharyn Boyer

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Over 90% of the salt marshes in the San Francisco Estuary (SFE) have been damaged or destroyed and in general, the diversity of salt marsh vegetation in the SFE has decreased over the past 50 years. Some salt marsh plant species are now quite rare and will require active revegetation to insure both their presence and their functions. This includes the endangered *Suaeda californica*, a salt-tolerant, succulent coastal wetland shrub that occurs in a narrow high tide zone along sandy salt marsh edges or estuarine beaches. The original native SFE population became completely extirpated around 1960. Plant material from Morro Bay was used to propagate and reintroduce juvenile *S. californica* to San Francisco Bay in 1999, and roughly 30 total plants have survived until now in three locations. As these low numbers hardly represent a restored population of *S. californica*, and the plants have not successfully self-recruited from seed, research is needed to understand the best methods to restore *S. californica* populations. The objectives of this project were to 1) determine the effects of abiotic conditions, including freshwater availability and organic matter, on the germination and growth of *S. californica*; and 2) evaluate the efficacy of "arbors" (various configurations of wooden branches as support) to enhance height growth of *S. californica*, which might enhance high tide refuge for endangered animals such as *Rallus obsoletus* and *Reithrodontomys raviventris*. Understanding factors that promote *S. californica* reproduction, germination, and growth will inform the maintenance of SF Bay salt marshes and the habitat they provide, while also assisting in the recovery of an endangered species. In doing so, this project will help preserve California's diminishing wetland habitats and help adapt to climate change and sea level rise.

Riparian Habitat Restoration on Rock Stabilized Levee Repair Sites

Chris Hargreaves, CPESC, and George Strnad*, RLA, CERP

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Following the devastation to New Orleans caused by levee failure during Hurricane Katrina, California's levee system in the Sacramento-San Joaquin River Delta was closely scrutinized by DWR for similar weaknesses. The key obstacle that prevented an immediate engineered repair of the levees was the presence of valuable natural resources at many of the eroded sites. Because of the very 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 restoration 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, we have developed an innovative soil-filled rock slope protection (RSP) technique. The soil-filled RSP guaranteed survival of riparian plants on heavily armored levee banks by providing capillary fringe via loamy soil fill. We have eliminated a non-permeable geotextile from the design and replaced it with a more environmentally-friendly, well-graded, gravel filter to prevent piping of the erodible substrate, while maintaining an elevated water table. Restoration plans were

developed for numerous levee repair sites on the banks of Sacramento and San Joaquin Rivers, and on Steamboat, Sutter, and Cache Sloughs. We have worked closely with DWR experts and staff from other resource agencies (CDFW, NOAA NMFS, USFWS, and USACE) to meet the demanding performance criteria. The key ecological goal to fully restore the sites and mitigate in-kind and in-place for any environmental impacts was deemed successful by the regulatory and permitting agencies two years after the planting was completed.

Exotic Species Invasion in Restored Vernal Pools

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Ninety-five percent of California's vernal pool ecosystems have been lost, resulting in a growing effort to restore these ecosystems and their associated endemic flora and fauna. However, because restored vernal pools often exist within a grassland matrix, they are prone to invasion by exotic annual grasses. We hypothesize that restored vernal pools are particularly susceptible to exotic invasion because restoration projects often have frontloaded short-term invasive species management. Long-term budget constraints often result in intensive exotic species weeding effort only 1-3 years after restoration. Even if these restored ecosystems show low exotic species abundance in the short term, they may not be resistant to exotic invasion in the long run. We assessed exotic species abundance and diversity after intensive weeding had ceased in a set of restored vernal pools in Southern California. We found that exotic species cover and richness increased, particularly around the edges of the pools. We hypothesize that this increase in exotics around the pools' edges indicates encroachment of exotic grasses from the upland grassland into the pools. Further, we found that the ratio of total native cover to total exotic cover decreased around the pool edges. These findings indicate that the native communities in our study's restored vernal pools are not resistant to exotic invasion. One way that restoration projects may increase a vernal pool's resistance to invasion is by employing an array of invasive species management techniques in addition to short-term weeding, such as bolstering the native seed bank and sourcing seed from competitive native ecotypes.

How (and Why) to Do Habitat Restoration

Michael J. Vandeman

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I will describe what I have learned from several years of intensive work removing invasive plants from the East Bay Regional Parks, including the application of mathematics, physics, and botany. All of these plants are very good at what they do, and can only be eradicated by the use of volunteers, and hence the use of the most energy-efficient techniques, which conserve the volunteers' valuable time and energy.

Post-fire Plant Community Trajectory and Fuelbreak Restoration

Hannah Weinberger* and Kristen Kaczynski

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As wildfires increase in extent and intensity, larger amounts of suppression tactics are utilized, including creation of fuelbreaks. There is limited research on fuelbreak restoration, so surveying can help inform best practices. We studied the 32 fire, located near Chico, CA. The site is comprised of annual grassland & forbs, California Black Oak, Manzanita & Wedgeleaf Ceanothus vegetation communities. A large fuelbreak was created on the north side to prevent fire from spreading. To assess post-fire recovery, we established plots in four vegetation types, stratified randomly based on three levels: burned, unburned reference, and disturbed fuelbreak. Sampling occurred 6-months post-fire. Sorensen Index results examining species presence/absence indicate burned Wedgeleaf plots were 44.3% similar to unburned Wedgeleaf plots, and burned Manzanita plots were 31.9% similar to unburned Manzanita plots. In the fuelbreak, these vegetation types did not have primary species of their respective unburned or burned vegetation type. Bray-Curtis Index results comparing similarities of species cover indicate Wedgeleaf fuelbreak plots were only 8.2% similar to unburned Wedgeleaf plots. Manzanita fuelbreak plots were only 5.3% similar to unburned Manzanita plots. This may indicate fuelbreak sites are on a trajectory away from original vegetation type. Regeneration of Manzanita and Wedgeleaf species on site occurs post-fire from the seedbank, so future recruitment in fuelbreaks is less likely. Additional research will be necessary to better inform fuelbreak restoration practices. Research assessing experimental plantings of fire-adapted shrubs in fuelbreaks would be beneficial, due to these species being unable to regenerate in areas that remain unburned.

Removing Introduced Trout from the Sierra Nevada to Benefit Native Species

Pete Zagorski

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Trout stocked in the High Sierra are known to be very effective predators that have a great influence on oligotrophic lakes with relatively simple foods webs and they impact many native species including fishes, amphibians, birds, reptiles, benthic macroinvertebrates and zooplankton (Knapp). One of the most affected species is the mountain yellow-legged frog, *Rana muscosa*, and *R. sierrae*, which has seen a dramatic decline since the introduction of trout to its habitat and has been placed on

the endangered species list (Sanders 2004). The predatory behavior of trout indirectly or directly impacts all trophic levels and can severely alter community structure. Efforts to remove nonnative trout from Sequoia and Kings Canyon National Park since 2001 have successfully eradicated trout from several lakes and have seen an average increase in frog density of 14-fold (NPT Staff 2016). Preferably, only physical methods of removal like gill-netting, electrofishing, disruption of nests and trapping would be used, but in certain cases the use of piscicides, which are fish-killing chemicals, is warranted for complete removal from a body of water. Improved stocking plans that consider the sensitivity of the ecosystem around the body of water being stocked coupled with continued removal efforts will help endangered species and restore balance to fragile mountain ecosystems in California.

Propagating Perennial Native Plants for Seed Production and Restoration Planting

Sandra Zepeda*, Joshua Morales*, and Matthew Hemming*

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Plant communities are threatened by the spread of invasive plant species, land overuse, climate change, and natural disasters. The National Seed Strategy was developed to promote native plant materials development, restoration efforts supporting native plant populations, and to conduct studies to improve the effectiveness of these efforts. These include germination studies to effectively propagate native plant species for planting on restoration sites, and container stock for seed production in a nursery setting. The Department of Agriculture and Natural Resources at Victor Valley College has partnered with the Bureau of Land Management to conduct research on perennial native species and how to successfully propagate them using experimental methods. Indigenous plant populations are being impacted from frequent wildland seed collection. By propagating natives, negative effects on indigenous populations can be reduced by substituting wildland harvest with cultivated seed, while also producing container plants for restoration efforts. The perennial species to be studied are *Krascheninnikovia lanata* (winterfat), *Larrea tridentata* (creosote), and *Achnatherum hymenoides* (Indian ricegrass). First, all *K. lanata* will be subject to cold stratification; half of these seedlings are going to be inoculated with Glomus endo-mycorrhizae. Next, propagation of *L. tridentata* will use three variations of a native soil mix containing native inoculum, commercial mycorrhizae, and a combination of both treatments. Lastly, *A. hymenoides* will consist of two trials testing nutrient applications: 1) incorporation of a seed sprout enzyme solution, and 2) application of a kelp nutrient.

Propagating Native Annual Plants for Seed Production in a Nursery

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Impacts to plant communities including wildfires, hurricanes, and climate change are becoming more frequent and intense. The National Seed Strategy was developed to promote restoration of native plant populations, and to support development of appropriate native plant materials for restoration. The Department of Agriculture and Natural Resources at Victor Valley College has partnered with the Bureau of Land Management to conduct research on annual native plants and how to effectively propagate them using various propagation methods. Acquisition of native seeds has relied heavily on seed collection from wild populations. Annual seed collected from native species every year can have a negative impact on wild plant populations at these sites. The goal for this research is to grow container plants that will be kept in a nursery setting for seed production to be used on restoration sites. This approach can decrease the impact on wild populations by collecting seeds from the nursery plants. Two annual grasses, *Bouteloua aristidoides* (needle grama) and *B. barbata* (sixweeks fescue), and one annual forb, *Plantago ovata* (desert indianwheat) are the species that will be studied in this project. *B. aristidoides* will be germinated using Glomus endo-mycorrhizae, which will be added during the beginning weeks of growth. Next, *B. barbata* will use three experimental inoculation treatments; 1) incorporation of native mycorrhizae, 2) application of commercial mycorrhizae, and 3) a combination of both treatments. Finally, *P. ovata* will be treated with sieved sand, lightly covered with soil then watered with diluted kelp tea to promote root development.

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Contact: Julia Parish, Southern California Director — **jparish@usaconservation.org**

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Contact: Colleen Haraden, Marketing Manager — 510.520.5417
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Contact: Diana Jeffery, Administrative Director —**admin@cnga.org**

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Contact: Tanner Yould — **tanner@cirweb.org**

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Contact: Dorothy Abeyta, Project Developer — **dorothy.abeyta@davey.com 925.391.5969**

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Contacts:

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John Zanzi, RLA Habitat Restoration Specialist, 916.438.5313 **jzanzi@dudek.com** 1102 R Street, Sacramento 95811

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

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Contacts: Max Busnardo, Principal — **mbusnardo@harveyecology.com**

Will Spangler, Senior Restoration Ecologist — wspangler@harveyecology.com

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

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Contact: Courtney Hunt, Academic Coordinator — **cchunt@uci.edu**

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Contact: Julie Maddox, Inside Sales Manager — 916.435.3555 **jmaddox@wildlandsinc.com**

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Contact: Carla Scheidlinger, Regional Restoration Program Manager | **carla.scheidlinger@woodplc.com** 858.300.4311

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

Beyond Recovery:
Restoration for the Future

SERCAL 2019 in Santa Barbara | Post Conference Fieldtrips April 12

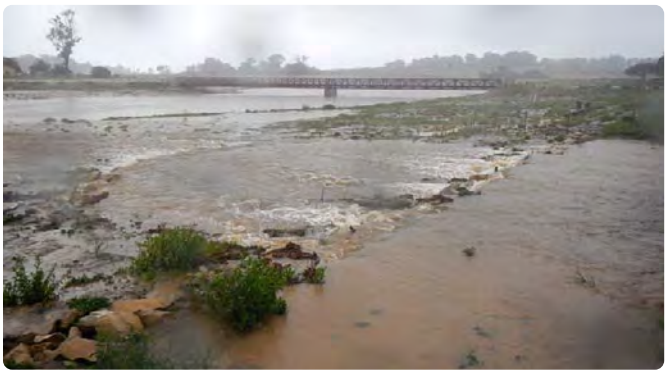
SERCAL is proud to offer this fine variety of fieldtrips to our conference schedule. Many thanks to the fieldtrip leaders and organizations for their time and energy!

When selecting a fieldtrip, please note the start/end times as well as what you can expect and what you should bring.

Please watch for updates on **www.sercal.org** prior to the conference and at the SERCAL administrative table at the conference. If a fieldtrip reaches maximum capacity before the conference, a waiting list will be maintained til the conference closing, April 11, 5pm.

A $20 administration fee is required to reserve your spot on a fieldtrip. Refunds will only be issued if your fieldtrip choice does not have any openings.

North Campus Open Space: Restoration of the Upper Arms of Devereux Slough and Mesa



Meet at 8:30am at 6969 Whittier Drive (Google Maps will get you there). Fieldtrip ends at approx. 11am.

Plan on wearing walking shoes (at least tennis shoes) and walking on uneven terrain. Hats, water, and binoculars recommended. Not too hilly or steep — about 80% flat with a short incline on a dirt trail.

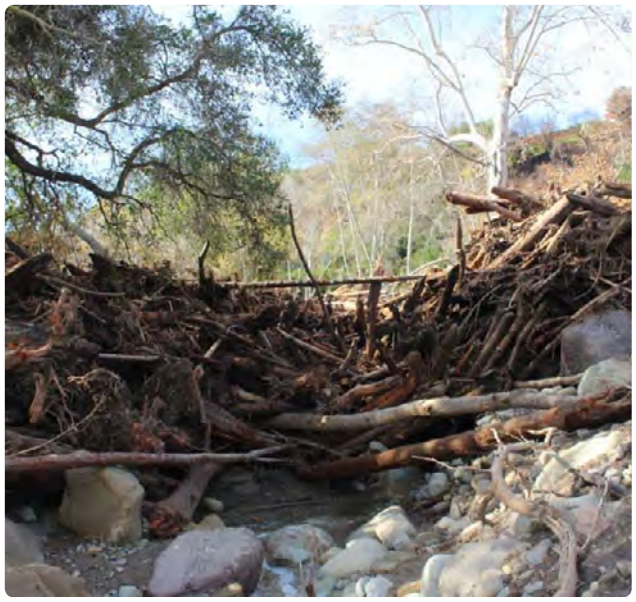
Maximum Number of Participants: Parking lot can hold about 20 cars and if more than 25 sign up (and carpool), we could potentially split into multiple groups with different members of the staff.

On this 2–2.5 hour tour, led by Darwin Richardson, Project Manager, you will walk about 2.5 miles, see birds and diverse locally sourced native plants, and learn about the history of this 100-acre restoration of a filled estuary. UC Santa Barbara's Cheadle Center for Biodiversity and Ecological Restoration (CCBER) has seen this project through from the beginning and currently employs more than 45 students and 20 staff on the project. The tour will cover information from the land purchase in 2013 through grant writing, goal setting, design, and implementation in 2017, to monitoring results to date. The project is designed to be adaptive to sea level rise, document carbon sequestration benefits, support rare species and other wildlife, as well as provide extensive education and outreach for students of all ages.

On the tour we will also walk through several adjacent, more established restoration projects implemented by CCBER over the years and learn about how CCBER has scaled up from 6 acre projects to this project through the use of apps, drill seeding, students and volunteers, and more.

Photo: Whittier pond emptying into Devereux Slough during the heavy rain on February 2, 2019.

Impacts to the Southern Santa Barbara County Steelhead Streams by the Thomas Fire and Debris Flows



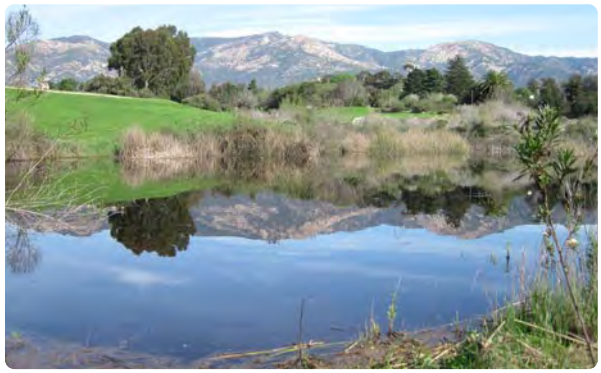
The devastating Thomas Fire in December 2017, and subsequent debris flows in January 2018 through 2019, have negatively impacted riparian and steelhead habitat in the Santa Barbara and Ventura Region. On this field tour, led by South Coast Habitat Restoration, we will visit creeks in Santa Barbara County and see the impact which occurred and the recovery to date. The tour will stop at various locations showing fish passage projects, debris basins and community efforts to deal with recovery and preparedness towards future disasters.

Meet at the conference center at 8:30am; we will return around 2:00pm. The California Conservation Corps should be able to provide vans as long as staff is not needed for firefighting; in that case, carpooling is encouraged.

Sturdy walking shoes, hats, sunscreen, water, and snacks recommended, as well as binoculars for bird-watching. Terrain is sloped and rocky at times but steep slopes and rocks can be avoided by staying on trails. Lunch not provided; there will be an opportunity to stop and purchase a sandwich/salad.

Maximum Number of Participants: 25

Arroyo Burro Watershed Restoration



Meet at the conference center at 8:30am; we will return around 3:30pm. The City will provide two 15-passenger vans. Before the fieldtrip departs, participants will have to sign a short waiver to ride in a City vehicle and participate in the tour.

Please bring sun protection, water, sturdy shoes, snacks and a bag lunch. We will be walking on trails with potentially steep or uneven terrain.

Maximum Number of Participants: 25

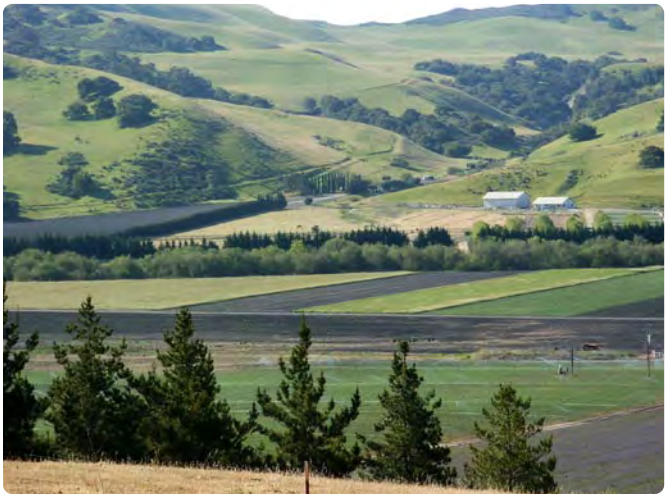
The City of Santa Barbara Creeks Restoration and Water Quality Improvement Division's mission is to restore riparian habitat and improve surface water quality throughout the City of Santa Barbara. Several restoration and water quality improvement projects have been completed throughout the Arroyo Burro Watershed. This tour, led by Creeks Restoration Planner Erin Markey, will take you from the upper Arroyo Burro Watershed to the creek mouth at Arroyo Burro (Hendry's) Beach to look at four different creek restoration projects in the watershed. Field tour stops include: the Barger Canyon Restoration Project, on a 15-acre property in the upper watershed which was previously in a degraded state from past land use practices, and was restored to a more historic condition in 2016; the Upper Las Positas Creek Restoration Project, completed in 2008, which combined native habitat restoration and stormwater management features to recreate wetland habitat on a tributary to Arroyo Burro on the City's municipal golf course; a recently completed project at the Arroyo Burro Open Space Park, a 21-acre property in the lower watershed at which floodplain connectivity and riparian habitat was restored; and lastly, the Arroyo Burro Estuary Restoration and Mesa Creek Daylighting Project, which was completed in 2007.

Jack and Laura Dangermond Preserve and S & S Seeds Los Alamos Garden Center

We will gather in Santa Barbara (location TBD) at 8:00, leave by 8:15 in 2 vans provided by S&S Seeds. Travel to Dangermond Preserve, arriving by 9:30. Tour three future restoration sites. Depart Dangermond at noon. Arrive at S&S Production Facility in Los Alamos at 1:00. Lunch provided by S&S. Tour facility and leave by 4:30 pm. Return to Santa Barbara at 5:20 pm.

Bring sturdy walking shoes, hat, binocs, water bottles and dress in layers as it can be windy and cold or warm, depending on where you are. Photos allowed for personal use only, TNC has a strict "no social media" policy. Photos are encouraged at the S & S Seeds production ranch.

Maximum Number of Participants: 30



In December 2017, The Nature Conservancy acquired the 25,000-acre Bixby Ranch at Point Conception through the extremely generous donation by Jack and Laura Dangermond. The beautiful oak woodlands, coastal terrace, coastal sage scrub foothills, and eight miles of coastline will be protected as the Jack and Laura Dangermond Preserve. Our vision is to create a world-class preserve dedicated to preservation and restoration, science and research, and environmental education. This part of the tour, led by Restoration Project Manager Laura Riege, will provide a brief glimpse into this special place — home to 54 special status species including 14 threatened and endangered species (6 animals and 8 plants). TNC is embarking on six restoration projects; this tour will visit three of them — 300 acres of ice plant treatment from coastal prairie, 200 acres of oak restoration, and a small project on a coastal bluff. Come see the "before" phase of these projects and learn about TNC's other plans for the Preserve.

S&S is working with TNC on seed collection and propagation for the restoration projects. After visiting the Dangermond Preserve in the morning, the tour will visit S & S Seeds' production facility in Los Alamos where a BBQ lunch will be provided, followed by a tour of the production fields, seed cleaning and conditioning mill, and the trial/demonstration garden where you will see nearly 100 California native species on display and in various states of maturity. This ranch is one of the few California native seed production farms in the state. S & S Seeds' Ben and Jody Miller will share their approach in ensuring that the highest quality, local ecotype seed material is available for restoration and mitigation projects.

Identifying and Appreciating the Native and Naturalized Grasses of California

SERCAL is pleased to include our partner organization's signature workshop — a morning of classroom instruction, lunch on your own, and an afternoon in the field. All net proceeds will go to CNGA.

The goal of this workshop is to give botanists, resource and range professionals, ecologists, as well as interested landscape professionals and home gardeners, the confidence and skills to key an unfamiliar grass, and recognize key characteristics and groupings. First, a brief introduction to the ecological history of California grasslands will be offered, followed by a summary of the current status of this valuable resource with respect to weed invasion, restoration, and land use. Although participants should have a basic understanding of dichotomous keys and plant anatomy, they will be introduced to the grass key found in the 2nd Edition of *The Jepson Manual* (Eds. Baldwin et al.), as well as online resources for assistance in keying. Participants will receive key excerpts and supplies to create reference specimens.

Taught by CNGA Board President Andrea Williams, a Vegetation Ecologist for Marin Municipal Water District on Mt. Tamalpais. She has worked in coastal grasslands from Northern California to Oregon off and on for 25 years.

We're Looking for a Few Great Volunteers!

Want to take a more active role in California's restoration community? SERCAL has some opportunities for you:

Join a Committee! **Communications** and **Budgeting & Marketing** both have openings.

Write an article for Ecesis! Our Communications Committee is developing upcoming issues on mitigation, technology, habitat design, rare plants, large-scale invasive species control, restoration or habitat design for threatened wildlife, vernal pools, watershed restoration, andmonitoring to inform future project development.

Join the SERCAL Board! Ask one of our Board members about opportunities. Elections are held in the Fall of each year.


Got a lot out of this year's conference?
Just wait til **SERCAL 2020**.
We're gonna have a whale of a time!
April in Monterey. Stay tuned to **sercal.org**
The time is NOW to get involved!
Talk to **Thor Anderson** and **Carol Presley**
about session ideas and more.