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California Society for Ecological Restoration

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HABITAT RESTORATION IN SANTA BARBARA COUNTY

Chair: **Mauricio Gomez** *South Coast Habitat Restoration*

Wednesday 15 May 10:30a — 12:00p and 1:30p — 3:00p *State Street Room*

& Thursday 16 May 8:30a — 10:00a *State Street Room*

Fish Passage Restoration on Agricultural Lands Across the South Coast.

Erin Brown* and Mauricio Gomez

South Coast Habitat Restoration, PO Box 335, Carpinteria 93014. erinbrown@schabitatrestoration.org

South Coast Habitat Restoration (SCHR) has been working for over five years to restore conditions for the federally endangered southern steelhead trout across Santa Barbara's South Coast. Steelhead runs have declined drastically as impacts from human activities have seriously altered the creeks and drainage systems where they live. Those impacts include: loss of native vegetation and an influx of exotic species, increased erosion, modifications to the creek channel and streambanks for flood control, barriers to upstream passage, degraded water quality from agricultural and urban runoff. This presentation will highlight the collaborative work with many agricultural landowners in the region to remove key migration barriers and restore upstream passage from the ocean to the headwaters of Carpinteria and Tajiguas Creeks. Various lessons learned will be shared including: permit strategies, threatened and endangered species issues, construction management, funding partnerships, funding strategies, landowner concerns and monitoring.

Santa Barbara County Noxious Weed Control.

David Chang

Agricultural Commissioner's Office, County of Santa Barbara, 263 Camino del Remedio, Santa Barbara 93110. dchang@co.santa-barbara.ca.us

The California Department of Food and Agriculture and the California Agricultural Commissioners are regulatory agencies that have the authority to control the distribution of noxious weeds identified in §4500 of the California Code of Regulations. Many of these noxious weeds threaten to disrupt and displace native plant and wildlife habitat, in addition to increasing management costs for farmers, and reducing the value of rangeland. The County of Santa Barbara Agricultural Commissioner's Office has been conducting eradication, management, and outreach on selected noxious weeds that are found in Santa Barbara County, such as *Arundo donax, Cynara cardunculus, Euphorbia terracina, Cuscuta japonica, Cirsium ochrocentrum, Acroptilon repens, Achnatherum brachychaetum* and other weeds. The presentation will describe the regulations governing noxious weeds, the extent of the infestation of the named weeds in the county, their biology, identification, and coordinated efforts to locally eradicate these species.

Post-Fire Restoration of a Eucalyptus Grove to Native Habitats.

Kathy Frye

City of Santa Barbara, Parks and Recreation Department, PO Box 1990, Santa Barbara 93102. kfrye@SantaBarbaraCA,gov

Quick response and planning efforts by the City of Santa Barbara, Parks and Recreation Department (Department) at Parma Park, dynamic partnerships, community action and seizing the opportunity lead to the successful return of native habitats where a Eucalyptus grove once stood. The Department manages the 200-acre Parma Park, a diverse open-space park containing at least six native habitats along with stands of exotic non-native species. Goals of the Department include the control and eradication of non-native species and native habitat restoration in addition to providing recreation opportunities in the park. The November 2008 Tea Fire burned over 90% of Parma Park, including an exotic 1.4-acre stand of blue gum Eucalyptus trees (*Eucalyptus globulus*). This mature grove of fire-damaged trees was determined a hazard and the Department took the opportunity to replace the non-native grove with native habitats found within the park. A combination of FEMA, Parma Park Trust, City and grant funds, and contractor, staff and volunteer labor resulted in a successful restoration project. Ms. Frye will talk about the management challenges of the Tea Fire, methods for clearing the Eucalyptus grove and controlling resprouts, adhering to integrated pest management practices, restoring native habitats, the response of the community and volunteers and post fire weeds in the restoration project area.

Santa Maria River Levee Habitat Restoration.

Robert Hobbs

RECON Environmental, 2027 Preisker Lane Suite G, Santa Maria 93454. rhobbs@reconenvironmental.com

The construction of a seven-mile levee along the Santa Maria River was to provide enhanced flood protection for the town of Santa Maria, CA in northwest Santa Barbara County. The levee construction required the disturbance of 120 acres of habitat. To compensate for 85 acres of unavoidable temporary impacts to vegetation, RECON designed and implemented a complex restoration program for the re-establishment of native riparian and upland vegetation along the entire length. The focus of the project was to develop a geomorphologically-based mitigation

approach that restored functions and values of contiguous areas of the river system and thereby increasing the habitat value of the associated upland and riparian corridor. The restoration program presented a number of issues which required a strategy of adaptation to overcome, including the linear configuration of the project area, the intermixing of habitat types, and the reduction of water in the stream system. These issues were effectively mitigated to meet the objectives of the program and keep the project on course towards successful completion in 2015.

Restoring Endangered Southern California Steelhead to an Urban Stream.

George Johnson

City of Santa Barbara, 620 Laguna Street Santa Barbara 93102.
gjohnson@santabarbaraca.gov

Small South Coast streams play an important part in restoring the endangered Southern California Steelhead. Unfortunately, many of these streams have been negatively impacted by urban development. Barriers to migration are the primary issue impacting steelhead restoration in these small coastal streams. Over the last 7 years, the City of Santa Barbara has been working to remove the barriers to migration on the lower section of Mission Creek. This section of Mission Creek is heavily urbanized and has two significant fish passage barriers. The largest barrier on lower Mission Creek is at the Caltrans Channels. The Caltrans Channels consist of two separate trapezoidal channels with concrete floors and banks designed to reduce flooding and allow for construction of Highway 101. The concrete channels create significant barriers to steelhead migration because flow rates and flow depths within the channels are too fast and/or too shallow for fish to swim upstream. The City is currently constructing an innovative fish passage design that will allow fish to migrate upstream through the concrete channels. The City also removed another barrier to fish migration on lower Mission Creek at the Tallant Road Bridge. This project was completed utilizing more standard methods of restoration through construction of a natural creek bed with native rock to improve fish passage conditions. Using two very different methods to remove migration barriers, these projects will allow fish to migrate upstream to spawning habitat in the upper watershed and help recover the endangered Southern California Steelhead.

Ellwood Grassland Restoration Project.

Johanna Kisner* and Julie Love

URS Corporation, 130 Robin Hill Road Suite 100, Goleta 93117.
johanna_kisner@urscorp.com

From May 2006 to January 2013, URS and subcontractors Deborah Shaw Landscape + Restoration and Growing Solutions implemented 1.5 acres of native grassland restoration on Ellwood Mesa in Goleta, California as a mitigation project for Comstock Homes' the Bluffs Along the Santa Barbara Coast residential housing development. A total of 26.4 pounds of native grass and forb seed was seeded and a total of 15,426 native grass plugs, and containers of forbs and a few native shrubs were installed over the 5 year maintenance and monitoring program. Weeding, seed collection, and plant propagation was implemented beginning May 2006 and plants and seeds were installed in fall 2007. Several lessons were learned from this project such as drill seeding was not effective using hand collected native grasses, unknown disturbed vernal pool habitats appeared in wetter years, grasses can grow over the summer if there is foggy weather conditions, English plantain (*Plantago lanceolata*) must be treated with herbicide, to name a few. The project achieved 70 percent native cover by the end of the program, which was much greater than native

continued

cover at the reference site which was about 57 percent.

Santa Barbara Airport Basin E/F Tidal Restoration.

Johanna Kisner and Julie Love*

URS Corporation 130 Robin Hill Road Suite 100, Goleta 93117. julie.love@ursc.com

In 2010, Basin E/F, a 10.3-acre freshwater basin in Goleta Slough on Santa Barbara Airport property, was restored to tidal influence. This basin had been tidally influenced prior to the filling and berming of the Goleta Slough associated with the original construction of the runway. The project was mitigation for the Airfield Safety Projects and was designed and implemented by URS and the Airport. Based on a tidal restoration feasibility study and a three year study of a 2.5-acre tidal demonstration basin installed in 2005 the project was also expected to reduce bird strike hazards because tidal areas would attract shorebirds that are less of a hazard than the larger, flocking waterfowl that occupy the freshwater basins.. Prior to implementation of the project, large waterfowl were attracted to the freshwater basin near the main runway in the winter season. Tidal flow was restored to the basin by creating two notches and channels in the berm between the freshwater basin and the tidally influenced Tecolotito Creek. Pickleweed (*Salicornia pacifica*) sprigs and topsoil were tilled into the basin along with supplemental planting and seeding of high marsh species. Habitat for special status species Coulter's goldfields (*Lasthenia glabrata* ssp. *coulteri*), tidewater goby *(Eucyclogobius newberryi),* and Belding's savannah sparrow (*Passerculus sandwichensis* ssp. *beldingi*) was also enhanced.

Invasive Plant Control in an Endangered Island Endemic Plant Population.

Kathryn McEachern[1], Katie Chess[1], Karen Flagg[2], Ken Niessen[1], Ken Owen*[3], Kevin Thompson[3], David Chang[4], Clark Cowan[5], and Jim Roberts[5]

[1]US Geological Survey, WERC, Channel Islands Field Station, 1901 Spinnaker Dr., Ventura 93001. [2]Growing Solutions Restoration Education Institute, P.O. Box 30081, Santa Barbara 93130. [3]Channel Islands Restoration, 550 Maple Street, Ste F., Carpinteria. [4]Santa Barbara Weed Management Area, 263 Camino del Remedio, Santa Barbara 93110. Dchang@co.santa-barbara.ca.us; [5]Channel Islands National Park, 1901 Spinnaker Dr., Ventura. ken@cirweb.org

This project highlights challenges involved in invasive plant removal from a Federally endangered plant population. *Galium buxifolium* (sea-cliff bedstraw) is endemic to Santa Cruz and San Miguel Islands, with 26 known populations. A large population on Santa Cruz Island was growing in the shade of a massive stone pine (*Pinus pinaea*) and was infested with *Vinca major* (periwinkle), an invasive non-native ornamental groundcover. In 2009, we began removing the *Vinca* so that native habitat can recover and support a self-sustaining *Galium* population. Repeated herbicide applications were made to eliminate *Vinca* from the steep bluff habitat. As the *Vinca* and *Galium* were often literally intertwined, we developed specialized techniques for *Galium* protection. In 2011, the stone pine was removed to stop its spread into the adjoining communities. Careful rigging and help from LACC volunteers ensured that no *Galium* were directly harmed as the tree was cut. Numbers of *Galium* plants have increased five-fold, from 123 in 2006, to 637 in 2011. We will treat and monitor again in 2013. Thus far our treatments have been successful in reducing *Vinca* competition without harm to the endangered *Galium*. While we did not detect any direct effects of stone pine removal, we do not know what the long-term effects of reduced shading might be on native plant recovery and *Galium* population growth. This project provides a strategy for invasive plant removal where exotics and endangered natives exist in close proximity, and it illustrates complications that arise when conflicting needs for invasive species control intersect.

Riparian Restoration Program in Santa Barbara County.

Andrew Raaf

Santa Barbara County Flood Control and Water Conservation District, 130 Victoria Suite 200, Santa Barbara 93102. asraaf@cosbpw.net

The Santa Barbara County Flood Control District manages urban creek corridors across much of the County. The agency has operated a restoration and management program for nearly 20 years and has performed nearly 24 acres of riparian restoration along more than 7 miles of riparian corridors. The Flood Control District's restoration program is proactive and includes small targeted restoration sites for aquatic habitat improvement, as well as a large mitigation "bank" for future regulatory compliance. Restoration efforts address riparian habitat values, public usage, climate adaptation, and special-status species. The Flood Control District's restoration program highlights success stories and lessons-learned for planning, permitting, monitoring, and execution of riparian restoration projects in southern California.

Making Divots in a Golf Course—Devereux Slough Restoration.

David Revell[1]*, Bob Battalio[1], Scott Stoller[1], Lisa Stratton[2], and Dave Harris[2]

[1]ESA PWA 740 Front St, Suite 345B Santa Cruz 95060. [2] CCBER, UCSB MC 9615, Santa Barbara 93106. drevell@esassoc.com

As purchase of the Ocean Meadows Golf Course nears completion the opportunity to restore the Upper Devereux Slough and the adjacent degraded coastal mesa begins to present

itself. Working in collaboration with UCSB's Cheadle Center for Biodiversity and Ecological Restoration (CCBER) and the Santa Barbara County Land Trust, ESA PWA has developed a conceptual engineering design of the restored upper slough. This restoration design is based on interpretation of historic ecology, consideration of soil characteristics, existing site conditions and existing patterns of vegetation. The goal of this conceptual design was to identify the amount of material that would be needed to excavate from the golf course to obtain the appropriate elevations needed to support the wetland vegetation assemblages formerly thought to have existed on the site. The grading plan for the excavated sediments was designed for placement on the adjacent upland South Parcel where the fill for the golf course originated. The upland restoration design focused on placing and contouring the sediments upland to recreate the mosaic of native grassland, vernal pool, and coastal mesa habitats that once existed along the Ellwood Mesa. This presentation will discuss some of the basis of design and conceptual design elements that have been incorporated thus far and outline next steps necessary to implement this ambitious restoration project.

Upper Devereux Slough: Refining the Vision for Restoring an Historic Coastal Wetland.

Lisa Stratton*, Dave Harris, Wayne Chapman, and Bryan Apple

Cheadle Center for Biodiversity and Ecological Restoration, UCSB MC 9615, Santa Barbara 93106. Stratton@ccber.ucsb.edu

Filled coastal wetlands abound in Southern California, but opportunities to unearth them are limited and precious. The Cheadle Center for Biodiversity and Ecological Restoration (CCBER) has been working since 2010 on realizing the vision of restoring the upper arms of Devereux Slough. Moving toward this vision has included grant writing, in conjunction with the Trust for Public Land, to purchase the land, researching baseline conditions, monitoring, and hosting planning meetings with biologists, community members, and agency representatives. Operating on a shoestring, non-mitigation budget, CCBER is moving toward a refined project description and looking for input on identifying criteria to make key decisions in the final design. Important design components include assessing the proportion of wetland habitat types in the face of climate change, assessing the limitations of an existing bridge on tidal connectivity, incorporating public access, and considering the fate of excavated soil *vis a vis* integrating the project with adjacent land scraped and used as fill in the 1960s. In addition, the design will consider such issues as how to integrate existing rare species and whether to serve as a repository for in-situ restoration of non-local, but rare plant and animal species. What are the key values that should drive a coastal wetland restoration project when mitigation requirements aren't a limiting factor?

Creek Restoration in Santa Barbara, California: An Overview of a Unique Program and Projects.

George Thomson

City of Santa Barbara Creeks Restoration and Water Quality Improvement Division, Santa Barbara 93102. gthomson@santabarbaraca.gov

Santa Barbara's city government includes a unique program dedicated to improving creek and ocean water quality and restoring natural creek systems through storm water and urban runoff pollution-reduction, creek restoration, and community education programs. A special, voter-approved funding mechanism allows the City to implement strategic watershed restoration projects and programs, compete effectively for grants, and ensure the long-term success of implemented projects. This presentation will provide an overview of the funding program and case studies of projects that target water quality improvement, invasive plant removal, storm water management and habitat restoration.

Rehabilitating Concrete Flood Control Channels to Create Steelhead Passage.

Ed Zapel

Northwest Hydraulic Consultants Inc, 16300 Christensen Road, Suite 350, Tukwila, WA 98188. ezapel@nhcweb.com

Many of the streams draining into the Pacific Ocean from the mountains of southern and central California pass through populated areas of the coast that have been built upon the alluvial plains of these streams. To accommodate continued suburban and urban growth in these populated areas, most of these stream channels were modified to increase their efficiency in carrying high flood flows, sediment, and debris safely by paving the bottom and sides of the channels with concrete. However, the high flow velocities and shallow depth occurring in these modified concrete channels make them almost entirely impassable to steelhead on their way upstream to spawning and rearing grounds in the upper portions of the watersheds. The precipitous decline in steelhead runs throughout Southern California over the past hundred years is evidence that these and other impacts are severe. Several concrete flood control channels in the Santa Barbara area have been modified or modifications are under construction to provide steelhead passage and safe flood flow capacity. The planning and engineering and design processes used to develop and implement these new channel designs are highlighted in this paper as representative of the innovative and cooperative effort undertaken by local governments and fisheries agencies to resolve a long-standing problem for the recovery of steelhead populations throughout southern California.

VENTURA RIVER PARKWAY— Reconnecting People With the River

Chair: **Paul Jenkin** *Surfrider Foundation*

Wednesday 15 May 10:30a — 12:00p *Flying A Studios Room*

Ventura River Parkway — Reconnecting People With the River.

Paul Jenkin

Ventura Campaign Coordinator, Surfrider Foundation, Ventura County Chapter, PO Box 1028, Ventura 93002. pjenkin@surfrider.org

The Ventura River Parkway provides a means of reconnecting a community with their watershed. The region is impacted by conflicts over water supply, flood damages, loss of habitat, beach erosion, and degraded surface and coastal water quality. Increased attention on the watershed and emerging planning processes may provide significant opportunities for integrated ecosystem-based management (EBM) solutions. Community-based watershed restoration projects at varying scales provide opportunities for ongoing outreach and education. This presentation outlines ongoing efforts to implement a vision for integrated watershed management by linking a holistic set of demonstration projects including the Surfers' Point Managed Shoreline Retreat, Matilija Dam Ecosystem Restoration, and provides the context for the other projects in this conference session and field trip. Current efforts to enhance the Ventura River Parkway provide a common thread that links these efforts through recreational trails and interpretive experiences.

It Takes a Community to Clean a River.

Derek Poultney

Ventura Hillsides Conservancy, P.O. Box 1284, Ventura 93002. dpoultney@venturahillsides.org

Habitat restoration never looked like this! *Arundo* removal just to get to the illegal encampments and trash? Site-prep WAS the entire project! Nobody ever taught me how to handle this in school…. For about 100 years, The Ventura River was a convenient place to sweep the homeless under the rug. "Better there than in town, right?" As a result of this mentality, the Ventura River became one of the hottest homeless destinations in the nation. However, it became so popular that the long-time river dwellers complained that their "quality of life" was deteriorating. It turns out that most came from thousands of miles away and drove out the natives (sound familiar?). Over the past 9 months, several property owners, government agencies, environmental organizations and social services came together to reclaim the lower Ventura River — to take a public eyesore (an environmental and economic liability) and turn it back into a public asset (a river parkway). I'll share the complex politics involved in turning the most densely populated and trash-ridden 9 acres of upper estuary habitat — right in the heart of downtown Ventura — into a nature preserve. Over 200 homeless people (about 75 large camps) and about 500 tons of garbage have been removed from the lower 2 miles of the Ventura River — with the help of up to 200 volunteers every month and a community committed to reclaiming its river. A lot to do before we could even think about restoration on our newest property.

Habitat Restoration, Public Recreation, and Flood Control — Making the Most out of Conservation Properties in the Ventura River Watershed.

Brian B. Stark

Conservation/Operations Director, Ojai Valley Land Conservancy. P.O. Box 1092, Ojai 93024. brian@ovlc.org

The Ojai Valley Land Conservancy has acquired almost 5 miles of the upper Ventura River floodplain, as well as other unique watershed lands, for habitat conservation and public access. This presentation will describe the multiple functions of our preserve system with a focus on habitat restoration and water quality improvement projects. Case studies will include the reclamation of a natural stream course at the Ventura River Preserve (Rice Creek), turning a flood control project into a wetland treatment and habitat project (Ojai Meadows), and plans for a Ventura River Watershed education center at the Ventura River Steelhead Preserve. Each featured project integrates public access and amenities with the surrounding natural environment. The presentation will touch on aspects of project design, site challenges, and both intended and unintended results.

Managed Retreat: Restoring Habitat, Resiliency, and Recreation at Surfers' Point.

Louis A. White, PE*[1], Bob Battalio, PE[1], David M. Hubbard[2], and Paul Jenkin[3]

[1]ESA PWA, 550 Kearny Street, Suite 800, San Francisco 94108. [2]Coastal Restoration Consultants, Inc., 5032 Pacific Village Drive, Carpinteria 93013. [3]Surfrider Foundation, Ventura County Chapter, P.O. Box 1028, Ventura 93002. lwhite@esassoc.com

Adaptation strategies for management of coastal flooding and erosion are limited for coastal communities at risk from sea level rise. Traditional methods for protecting backshore property and infrastructure, such as shoreline armoring, can accelerate beach erosion and result in deteriorated coastal ecology and recreation. Innovative solutions, such as managed retreat, provide opportunities for reducing risk to infrastructure and

property while improving recreation and restoring beach ecosystems. Winter storms of 1992 significantly impacted the Ventura coast, and caused considerable erosion of the existing bike path and parking lot at Surfers' Point in Ventura, California. A managed retreat approach was implemented in 2010-2011 along 1,000 feet of shoreline east of the mouth of the Ventura River to improve beach access and reduce coastal flooding and erosion risks by restoring natural dune and cobble beach habitats. Reconfiguration of the existing parking and bike path involved replacing 14,000 cubic yards of artificial fill with over 30,000 tons of rounded cobble stone and sand, widening the beach by over 60 feet and serving as natural shore protection. Sand dunes were graded and planted using imported dune sand and native seed and stock. The new bike path provides a contiguous connection from the Ventura River Parkway to the coast, and is a popular thoroughfare for the community. The project is widely considered one of the first efforts for adapting and planning for sea level rise on the California coast, and will hopefully serve as a template for development of design guidelines for other managed retreat projects.

UPLAND RESTORATION

Chair: **Pete Tomsovic** *Principal, RECON Environmental, Inc.*

Wednesday 15 May 10:30a — 12:00p and 1:30p — 3:00p *Santa Barbara Harbor Room*

Increasing Native Milkweed Seed Availability for Monarch Butterfly Habitat Conservation.

Brianna Borders*, Eric Mader, Mace Vaughan, and Scott Hoffman Black

The Xerces Society for Invertebrate Conservation, 628 NE Broadway, Suite 200, Portland, OR 97232. brianna@xerces.org

Milkweeds (*Asclepias* spp.) are the obligate host plants of monarch butterfly (*Danaus plexippus*) caterpillars and support diverse invertebrate wildlife with their nectar. The loss of milkweed from the monarch's western breeding range is considered a significant factor contributing to declining monarch numbers recorded at overwintering sites on the California coast. To offset the loss and degradation of monarch breeding habitat, monarch conservationists recommend planting regionally appropriate native milkweed species. However, commercial sources of milkweed seed have been scarce across the southern tier of the United States, limiting opportunities to include the plants in habitat restoration efforts. In 2010, the Xerces Society launched *Project Milkweed,* to increase milkweed seed availability in six states, including California. Through a national USDA-NRCS Conservation Innovation Grant, Xerces is offering technical support and funding to native seed producers to incentivize the production of regionally-adapted milkweed seed. In California, our partnership with Hedgerow Farms (Winters, Yolo County) has been highly successful, with over 150 pounds of narrowleaf milkweed (*A. fascicularis*) seed produced and three additional species in production. This initiative is effectively expanding the variety of native plant materials available for restoration projects. Concurrently, Xerces is encouraging the inclusion of these valuable plants in pollinator habitat enhancement projects on agricultural lands, and large-scale plantings by transportation agencies, resource conservation districts, and natural resource agencies. These combined restoration activities will contribute to monarch conservation by increasing the abundance of their larval host plants on a region-wide basis, while also supporting pollinator populations.

Restoration SWPPPs; Applying the Construction General Permit to Habitat Restoration.

Allegra Bukojemsky (Moderator)[1], Eric Bernsten[2], Scott Taylor[3], David Franklin[4], and Michael R. Chase[5]

[1]Wildlands, 3855 Atherton Rd, Rocklin 95765. [2]State Water Resource Control Board, 1001 I Street, Sacramento 95814. [3]RBF Consulting, 5050 Avenida Encinas, Suite 260, Carlsbad 92008, and California Stormwater Quality Association Policy and Permitting Co-Chair. [4]EnviroTech

continued

Services, PO Box 195, Tomales 94971. [5]SoundEarth Strategies, Inc., 3000 Joshua Court, Bakersfield 93301. allegrab@wildlandsinc.com

Construction projects disturbing over an acre of land are required to have Construction General Permit coverage to meet the requirements of the Clean Water Act. The details and timing of restoration projects can be significantly different from a standard construction project. However, existing guidance and documentation is focused on standard building and infrastructure projects. This can make the preparation and implementation of Stormwater Pollution Prevention Plans (SWPPPs) and permit coverage a challenge for restoration projects. What are some of the conflicts and challenges of a restoration project and permit requirements? What are some of the key differences between restoration and standard construction SWPPPs? What adaptations can be made? What should future guidance and permit requirements consider? A panel of experts including regulators, policy and guidance experts, and QSD/QSP trainers will be led in a discussion of these issues and then open the discussion to questions and concerns from the audience.

Restoration Beyond Implementation: Ensuring Sustainable Outcomes in Southern California Ecosystems.

David Harris

Cheadle Center for Biodiversity & Ecological Restoration. DHarris@ccber.ucsb.edu

Ecological restoration is a dynamic process of resource assessment, planning, implementation, and management. In an effort to achieve our desired ecological outcomes we set out to restore specific biotic and abiotic functions that are known to support our target species. In this pursuit restoration ecologists and practitioners typically refer to naturally occurring ecosystems as archetypes for restoration design. However, the ecosystems we see today have experienced a millennia of successional evolution tied closely to the renewal brought on by natural and human driven disturbance regimes. While succession continues to progress towards climax ecosystems, many renewal mechanisms such as flooding, fire, and natural grazing cycles have largely been altered or abolished. In light of this, we must look beyond the limited implementation periods typically afforded to restoration projects and consider long-term ecological trajectories in the absence of historic renewal mechanisms. Specifically, we must restore the underlying processes that maintain ecosystem function in the long term, and develop management regimes that provide the renewal that ecosystems need to maintain their complexity and vigor. Through sharing CCBER's insight and others' research into the issue, this presentation will touch on the historical context under which Southern California's natural ecosystems have evolved, recent changes to this context, and how we as restoration ecologists may need to alter our approach in order to carry our present-day restoration goals into the future.

The Sunrise Powerlink Habitat Restoration Program.

Cecilia Meyer Lovell*[1], Marc Doalson*[2], James Prine*[1], Scott Boczkiewicz[2], Pete Tomsovic[3], and Robert Hobbs[3]

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How does one go about restoring 350-plus acres, over 117 miles, six eco-regions and 20 sensitive vegetation communities? Over the past 2 years, San Diego Gas and Electric (SDG&E) and the AECOM/RECON team have been focused on implementing upland and waters/wetland habitat restoration, as well as restoring special-status plants, cactus transplantation for Peninsular big horn sheep (*Ovis canadensis nelsoni*), and Quino checkerspot butterfly (*Euphydryas editha quino*) host plants, for temporary impacts associated with the Sunrise Powerlink. This split 230kV and 500kV transmission line extends from the deserts of Imperial County, over the mountains to western San Diego County, conveyingelectricity from renewable energy facilities. SDG&E started planning for restoration early, with the foresight to begin a native seed collection program in 2010, before construction began. Seed for various annual and perennial species was targeted for collection, with seed for additional species opportunistically collected. The AECOM/RECON team conducted pre-construction surveys to document baseline conditions for restoration, coordinating cactus salvage, topsoil salvage, decompaction, and re-contouring during construction to support restoration efforts. Over an 8-month period, we prepared 60 Site-Specific Restoration Plans (Plans) that included pre-construction data and success standards for each site, as well as site-specific seed mixes tailored to site conditions and vegetation communities present. We conducted implementation of these Plans in the winters of 2011/2012 and 2012/2013 and have begun the 5-year Maintenance and Monitoring Program. An effort this large can be challenging, but with proper planning and foresight, all of the important elements of successful restoration ecology can be applied.

Mapping Habitat Suitability for Dryland Restoration andAt-risk Plant Reintroduction.

Erin J. Questad*[1], James R. Kellner[2], Kealoha Kinney[2], Susan Cordell[3], Gregory P. Asner[4], Amanda Uowolo[3], and Sam Brooks[3]

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Finding suitable habitats in fragmented and degraded landscapes is a major challenge to restoration and reintroduction programs for plant species at risk of extinction. Desiccation and water stress are significant barriers to survival for over 40% of at-risk plant species that occur in dry or rocky habitats. We examine how microtopographic features that reduce water stress and increase resource availability can be modeled for landscape planning that can increase the success of restoration efforts in drylands. We developed a topographic habitat suitability model (HSM) from airborne Light Detecting and Ranging (LiDAR) data as a tool to enhance landscape planning for at-risk plant species reintroduction for a dryland landscape in Hawaii. We are currently developing a similar model for our first site outside of Hawaii: Vandenberg Air Force Base in Santa Barbara County, CA. The HSM identifies topographic depressions that are protected from prevailing winds (high suitability sites) and contrasts them with ridges and other exposed areas (low suitability sites). In our field tests of the HSM microclimatic conditions and plant-response traits indicated better growing conditions in high suitability sites compared to low suitability sites. The locations of six at-risk plant species showed associations with high suitability areas, and the survival of planted individuals of *Dodonaea viscosa* was less variable among high suitability plots. These results suggest that the HSM can improve plant establishment and survival, reduce the cost of restoration and reintroduction programs through targeted management activities in high suitability areas, and expand landscape-scale restoration planning capabilities.

Strip-seeding for Low-cost Grassland Restoration: A Progress Report.

Andrew P. Rayburn[1]*, Heather Spaulding[2], Jessica Musengezi[1], Craig Schriefer[1], Toby O'Geen[2], and Emilio A. Laca[1]

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California grasslands provide valuable ecosystem services including biodiversity, wildlife habitat, pollinator resources, livestock forage, and both water and carbon storage. Provision of these services has been diminished by exotic species invasion, loss of native species, and land conversion. Grassland restoration is increasingly demanded in California; however, high costs limit its adoption. Reducing cost is critical to increasing the viability of restoration as a management option. We report our progress to-date on an innovative grassland restoration experiment initiated in fall 2011 that tests different strip-seeding configurations as lower-cost alternatives to traditional "wall-to-wall" seeding methods. Strip-seeding refers to planting seeds in strips to some fraction of a site, concentrating planting effort to increase native species establishment while decreasing seeding costs. With appropriate management, seeded species should disperse and colonize unseeded areas without further direct seeding. Given strip configurations appropriate for site conditions and management objectives, we hypothesize that positive restoration effects on ecosystem services will approach levels achieved through "wall-to-wall" seeding at a lower cost. Data collection in seeded and unseeded strips has included aboveground plant biomass, soil, seedbanks, arthropods, water infiltration, light, temperature, and soil moisture. Ongoing analyses suggest that native grasses disperse into unseeded strips and establish, with strong variation between species, and that strip configurations are influencing arthropods dynamics, infiltration rates, and microclimate variables. Our economic analyses are also tracking costs per area and per unit ecosystem service for different strip-seeding configurations, and suggest that ecosystem services can be restored at a significantly lower cost than traditional methods.

SANTA CLARA RIVER PARKWAY

Chair: **Matt James** *Coastal Restoration Consultants*

Wednesday 15 May 10:30a — 12:00p *Flying A Studios Room*

The Santa Clara River Parkway: Protecting Riparian Biodiversity in a Rapidly Urbanizing Landscape.

Peter Brand

CA State Coastal Conservancy, 1330 Broadway, 11th Floor, Oakland 94612. brand@scc.ca.gov

Large-Scale Riparian Restoration in the Santa Clara River.

Adam Lambert*[1], Tom Dudley[1], Bruce Orr[2], and Zooey Diggory[2]

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A consortium of restoration scientists, practitioners, and conservation organizations is implementing a river-reach scale arundo (*Arundo donax*; giant reed) control and habitat restoration program in the Santa Clara River. The program targets an extensive and biologically diverse floodplain and wildlife corridor to restore critical habitat for threatened and endangered species. The California State Coastal Conservancy's *Strategic Plan for Arundo Treatment and Post-Treatment Revegetation* (2011) for the lower watershed is being used to guide project implementation and evaluate strategies for reducing costs while meeting ecological goals. The objectives of the program are to: 1) Implement riparian restoration at a sufficient scale to re-establish the ecosystem structure, function, and processes necessary to recover sensitive and listed species, 2) Establish a scientifically-based monitoring program to measure wildlife responses to restoration treatments, as well as overall project effectiveness, and 3) Evaluate response data to document successful strategies, adjust unsuccessful restoration practices, and inform future projects in the region.

Arundo Eradication Using Imazapyr on Santa Clara River (Santa Paula).

Ken Owen*[1], Brian Holly[2], and Kevin Thompson[3]

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Recent use of Imazapyr herbicide in Southern California to eradicate *Arundo donax* has shown promising results, and Channel Islands Restoration (CIR) used it to treat an approximately four acre site along the Santa Clara River in the City of Santa Paula starting, in 2011.The project is required to mitigate effects from construction of the City's new wastewater facility in least Bell's vireo, willow flycatcher and western pond turtle habitat. A flail mower masticator was used to cut the *Arundo* and Imazapyr was sprayed on the *Arundo* when it initially re-sprouted. The re-sprout rate after treatment with Imazapyr was less than 1% (approximately 30 stocks) a far lower re-sprout rate than what CIR has experienced using Glyphosate based herbicides at other sites. Imazapyr was also used to treat the *Arundo* that did re-sprout, and CIR subsequently planted the site with container stock and direct seeded portions of the site. In addition to the increased efficacy of Imazapyr compared to Glyphosate, Imazapyr only requires partial coverage of the plant with herbicide, resulting in less herbicide use. BioResource Consultants is monitoring the effects of the restoration on the vireo, flycatcher and pond turtles. This five-year project will serve as a good demonstration of the long-term efficacy of the use of Imazapyr based herbicides for *Arundo donax* control.

Modeling Fluvial Climate Change Impacts to the Santa Clara River.

David Revell[1]*, Bob Battalio[1], James Gregory[1], Sarah Newkirk[2], and Lily Verdone[2]

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Modeling of climate change impacts have largely focused on changes to temperature and precipitation and resulting impacts to coastal areas from sea level rise, and results are rarely incorporated into planning and local level decision making. As a result of The Nature Conservancy's Coastal Resilience Ventura project, climate change modeling is being coupled with a stakeholder process to identify and generate climate change products which can be directly incorporated into planning decisions. In addition to coastal flooding, ESA PWA modeled changes to fluvial flooding along the Santa Clara and Ventura River using HEC-RAS models developed for FEMA. The fluvial modeling was expanded to examine changes to precipitation as projected by downscaled Global Circulation Models (GCMs). In addition the modeling considered changes to flooding and river bed elevation as a result of sea level rise. These revised models show some changes in the flood extents over time and are providing The Nature Conservancy with additional information needed to inform planning and acquisition of the Santa Clara Parkway project.

COASTAL RESTORATION & SEA LEVEL RISE

Chair: **Dr. Monique Myers** *Sea Grant Marine Advisor*

Thursday 16 May 8:30a — 10:00a and 10:30a — 12:00p *Flying A Studios Room*

The Los Cerritos Wetlands Restoration Project Alternative Development Process.

David Cannon

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In February 2006, the Los Cerritos Wetlands Authority (LCWA), which is composed of the Rivers and Mountains Conservancy, California State Coastal Conservancy, City of Long Beach, and City of Seal Beach, was established to provide for a comprehensive program of acquisition, protection, conservation, restoration, maintenance, operation, and environmental enhancement of the Los Cerritos Wetlands consistent with the goals of flood protection, habitat protection/restoration, water supply, improved water quality, groundwater recharge, and water conservation as well as restoration planning and implementation. In 2011, the LCWA embarked on the Los Cerritos Wetlands Restoration Project (LCWRP) to meet these goals through development of conceptual restoration alternatives. The Los Cerritos Wetlands area lies in the middle of an urban area surrounded by various residential, commercial, and industrial land uses. Two streams that also serve as flood control channels pass through the site and oil exploration/production facilities are spread out across the area limiting hydraulic and wildlife connectivity. The development of conceptual restoration alternatives that meet the goals of the LCWA in consideration of the various opportunities and constraints posed a challenge to the consultant team (Team) that was selected to assist the LCWA with the start of the LCWRP. To meet this challenge, the Team developed and implemented a systematic approach to develop a range of restoration alternatives. The development and implementation of this alternative development approach is the topic of this presentation.

The Los Cerritos Wetlands Conceptual Restoration Plan.

Kim Garvey* and Chris Webb

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The Los Cerritos Wetlands (LCW) complex represents an opportunity to restore over 500 acres of salt marsh, seasonal and other freshwater wetlands, open water and transitional/upland habitat within an urbanized area of southern California. The LCW complex straddles the boundary of the Cities of Long Beach and Seal Beach. Historically, the complex covered 2,400 acres. Today, only remnants of the historic wetlands occur in degraded patches. Much of the site has been used and continues to be used for oil operations. The LCW Conceptual Restoration Plan is an ongoing study to provide a roadmap for habitat restoration and enhancement, improved public interpretive opportunities and access to the site. Planning is being led by the Los Cerritos Wetlands Authority, a Joint Powers Authority comprised of the California Coastal Conservancy, San Gabriel and Lower Los Angeles Rivers and Mountains Conservancy, and the Cities of Long Beach and Seal Beach. The scope of the study, under contract to Moffatt & Nichol and a diverse team of subconsultants, is to characterize the existing site, identify opportunities and constraints to restoration, collaborate with technical advisors and public stakeholders, and develop and analyze restoration alternatives. The work is significantly complete.

Opportunities and Constraints for Estuarine Restoration as Sea Levels Rise.

John Heal

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continued

Over 90% of the estuarine wetlands in California have been lost. This study is a literature review of the current knowledge of sea level rise, its potential impact on the remaining estuarine wetlands in California, and the opportunities and constraints to protecting and enhancing those natural resources. The history of coastal development in California was reviewed by studying aerial photographs (both historic and current) with an overlay illustrating the sea level rise for the San Francisco Bay area and for Ventura County. A review of the literature yields a consensus that sea levels may rise approximately 16 inches in the next 40 years, primarily due to thermal expansion of the oceans. This nascent rise of sea levels has the potential to substantially harm and negatively impact the estuaries in these two regions of California, and their functions and values. Current policies that include consideration of sea level rise are reviewed and the opportunities and constraints for mitigating the impacts of sea level rise on estuarine wetlands are described, including suggested changes to policies and directions for future research.

Sea Level Rise as a Restoration Tool at Los Cerritos Wetlands.

Matthew James and David M. Hubbard*

Coastal Restoration Consultants, Inc., 5032 Pacific Village Dr. Carpinteria 93013. dave@crcsb.com

Sea level rise (SLR) has been a central element in the development of the conceptual restoration plan for the Los Cerritos Wetlands complex. The restoration plan focuses on areas that were historically part of a large estuary but have been largely cut off from tidal flow by flood control structures and filling with dredge-spoil. Three sub-areas of the complex, separated by major levees and roads, generally get higher in elevation from west to east. Looking at current conditions and scenarios in 50 years (two feet SLR) and 100 years (five feet SLR), we were able to evaluate the changing extents of low, mid- and high tidal marsh habitats in these three areas over time using GIS. The western and middle areas of the complex are currently at elevations suitable for supporting mostly mid- and high marsh habitat, but lack tidal flow. There is good potential for improving hydrological connections on these sites with only minor grading to provide mid- and high-marsh habitat that will convert to sub-tidal and low/mid marsh over time. In the higher eastern area tidal restoration would yield short-term high marsh and transition habitat with minor re-contouring and laying back of slopes. These areas will become the mid and high marsh of the future. By allowing habitats to migrate upslope within and between the three areas over time, potential earth moving costs are significantly reduced and long-term habitat diversity within the complex will be maintained over time.

Planning for Sea Level Rise in Tidal Marsh Restoration.

Ingrid Morken*, George Salvaggio and Geoff Smick

WRA, Inc., 2169-G East Francisco Blvd., San Rafael 94901. morken@wra-ca.com

Much of the San Francisco Bay's tidal marshes have been lost due to agriculture, fill and development, and as sea levels rise, even more will be inundated. For the Breuner Marsh project, a tidal marsh restoration and public trail project located on East Bay Regional Park District property in Richmond, California, we developed tools and methods to plan for sea level rise to restore and maintain tidal marsh habitat at the site over time. The Breuner Marsh project will restore over 30 acres of tidal marsh and seasonal wetland habitat through the removal of fill in an area historically occupied by tidal marsh and other sensitive habitats. To evaluate the change in distribution of tidal marsh habitat at this site, we used elevation data and Geographic Information System (GIS) 3-D modeling to map and quantify the area of the low marsh, high marsh, transition zone, and uplands following construction of the restoration site as well as conditions predicted 70 years into the future when an approximate one meter rise in sea level is predicted. With the results of the sea level rise evaluation, we determined how the tidal marsh habitat will migrate to higher elevations and used this data for assessing design alternatives of the restoration plan. We also used this information to preserve existing low-lying uplands which will convert to tidal marsh habitat and to ensure that the location of new public access facilities are at elevations which will be protected from rising sea levels in the future.

Climate Change and Coastal Wetland Response—Coastal Resilience Ventura.

David Revell[1]*, Bob Battalio[1], Elena Vandebroek[1], Sarah Newkirk[2], and Lily Verdone[2]*

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As part of The Nature Conservancy's Coastal Resilience Ventura (CRV) Project Team, ESA PWA has conducted sophisticated climate change modeling of the impacts of sea level rise to Ventura County. This CRV project has engaged regional stakeholders and scientists to provide project development guidance and peer review to make sure that the project supports local level decisions and ongoing planning processes. The physical process models integrate coastal erosion with coastal flooding in 10-year time steps to illustrate the changes in coastal hazards across Ventura County. This project has also evaluated changes in fluvial discharge and flood extents as a result of changes to precipitation and sea level rise. To account for the uncertainty in climate change projections, ESA PWA has taken a spatial aggregation to map

areas of higher certainty of climate change impacts. Results from the physical process coastal and fluvial models are being used as inputs to drive an ecological evolution assessment using SLAMM (Sea Level affecting Marsh Model), which simulates wetland conversions during long-term sea level rise. As part of the larger CRV project, results of this climate change modeling are being incorporated into local planning decision, restoration planning along the Santa Clara Parkway, and wetland restoration along the Ormond Beach site.

Los Cerritos Wetlands Restoration: Past, Present, and Future Habitat Types.

Eric Zahn

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The landscape of the San Gabriel River Estuary has changed dramatically over the past century. Historically, this river culminated in 2,400 acres of coastal salt marsh, however, this ecosystem has been progressively altered and become ever more complex with overlays of urban infrastructure such as flood control facilities, power generating plants, oil operations, roadways, and other developments. Forecasted sea-level rise puts urban developments in coastal flood plains at potential risk to flooding and property damage. Understanding existing habitat types and surrounding urban land uses allows for us to explore ways to utilize theories of restoration ecology to protect commercial, residential and industrial developments from future threats of global climate change. As part of the Los Cerritos Wetlands Conceptual Restoration Plan, we have contrasted the historic vs. existing habitat types within the remaining 540 acres of undeveloped open-space to determine the best habitat to restore in the future. GIS analysis of historical ecology and current habitat mapping shows that before development of the estuary, 88% of the project area was coastal salt marsh compared to the 11% that currently exists, while historically unidentified plant communities like mulefat scrub and alkali meadows are succeeding throughout the project area. A major goal for the Los Cerritos Wetlands restoration project is to restore tidal influence to much of the landscape. This conceptual planning process is carefully considering how to properly reintroduce tidal wetlands without impacting urban developments and minimizing impacts to valuable freshwater habitats that have become established.

WETLAND AND RIPARIAN RESTORATION

Chair: **Harry Oakes** *ICF International*

Thursday 16 May 8:30a — 10:00a, 10:30a — 12:00p, and 1:30p — 3:00p *Santa Barbara Harbor Room*

Invasive Aquatic and Riparian Weeds and Mosquitoes; Challenges, Successes, and Importance of On-going Studies.

Charles E. Blair, MD

Trustee, Mosquito and Vector Management District of Santa Barbara County and Member Southern California Vector Control Environmental Taskforce,176 Alcor Ave. Lompoc 93436-1206.
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The adverse effects of invasive aquatic and riparian weeds on water quality; hydrology, native plant communities, and wildlife habitat and their consequences for mosquito control efforts, public health and nuisance problems, have been often implied, but could be better articulated. This presentation will present some of these relationships and highlight collaborative activities among vector and weed control agencies. Invasive aquatic and riparian weeds result in several adverse changes in these settings. Displacement of native flora degrades habitat for fauna that feed on mosquito larvae and pupae. The use of biorational larvicides, some derived from bacterial sources that do not harm this fauna supplements the effectiveness of their predation, which can reduce or eliminate the necessity of aerial adulticide application. There are situations where the density of invasive flora has been shown to interfere with application of these agents. Mosquito breed in standing water, which can include still-water natural areas, such as ponds, and small lakes and also moving water areas streams and tidal areas with changing levels which leave isolated standing water areas. Manmade sources include landscaping, irrigation canals, ponds, storm drain holding areas, and wastewater recharge basins. Examples of specific problems in particular settings will be described: for still water, *Ludwigia* spp.; for estuarine, *Spartina* spp.; and riparian, *Arundo donax.* Successful projects that can be applied elsewhere, lessons that can be learned from unsuccessful activities, and the need for continuing investigations will be discussed.

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The Sunrise Powerlink and Desert Dry Wash Habitat Restoration.

Scott Boczkiewicz

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Hydrologic impacts to desert dry washes and playas have become a new focus for impact minimization and post-construction restoration as California utility renewable energy portfolio standards drive renewable energy project developments to the eastern deserts. How compatible is electric transmission infrastructure with desert dry washes? To what extent can the short- and long-term effects of construction impacts be minimized on desert dry washes? What is the potential natural response of desert dry washes in reestablishing pre-construction geomorphic and vegetative conditions, and how active or passive can our restoration efforts be? Since 2009 San Diego Gas & Electric has worked with WRA to help permit construction impacts to Waters of the U.S and Waters of the State resulting from construction of the 117 mile long 500kV transmission line. The majority of project impacts to waters resulted from the eastern reach of the project through extensive dry washes in the Sonoran Desert of Imperial County. Utilizing an extensive pre-planning and engineering revision process and a successful practice of impact minimization during project construction, a significant portion of the anticipated project impacts were avoided. In July and August 2012, a series of 25-year monsoonal rain events opportunistically flooded the Sunrise Powerlink project area in the Sonoran desert several months after construction was completed. The permanent and temporary impacts to desert dry washes resulting from the project are reviewed in the context of these monsoons, and what subsequent effort is or will be required to reestablish pre-construction geomorphic and vegetative conditions.

Factors Affecting Population Fluctuations of Ventura Marsh Milk-Vetch at North Shore since its Rediscovery.

Mary Carroll*[1], Doug Fischer[1], and Mary Meyer[2]

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Ventura Marsh Milk-Vetch (*Astragalus pycnostachyus* var. *lanosissimus*) was thought to be extinct in the wild until almost 400 individuals were discovered by USFWS on a former oil waste site (North Shore at Mandalay Bay) in Oxnard, CA in August 1997. Since then, periodic censuses of this short-lived herbaceous perennial have been conducted by various biologists, especially CDFW. Compiled data reveal pronounced swings in numbers of adults, juveniles, and seedlings from year to year, depending on precipitation, herbivory, and weed infestations. These population fluctuations are also observed in several outplanting sites monitored by CDFW. When ARCADIS began work at the site in early 2009, the Ventura Marsh Milk-Vetch North Shore population had shrunk to 29 adults and one juvenile and shrunk further to 20 adults by the end of the year. Several steps were taken to reverse the decline on this endangered herbaceous perennial, including installation of a subterranean moisture system and hand removal of weeds and non-native snails. This presentation will summarize the current status of the only wild population of Ventura Marsh Milk-Vetch, including a discussion of factors affecting population fluctuation and stability.

Necessity of Art in Ecological Restoration: Aesthetics for a Post-Natural World.

Robert Louis Chianese

English Department, CSU Northridge; America Association for the Advancement of Science, Pacific Division; Ventura Hillsides Conservancy; *American Scientist* columnist; 2465 Hall Canyon Road, Ventura 93001. rlchianese@gmail.com

Ecological restoration projects depend on scientific feasibility, design, funding, community buy-in, appreciation, and maintenance. The arts play a vital role in five of these six factors. More than ornamentation or consciousness-raising, art brings new forms of knowledge to their design, operation, and essential community buy-in. Appreciating restored natural features beyond their environmental and social value requires re-education of our sensory, emotional, and psychological responses to them. These "artificial" remakes require new aesthetics, one that educates our responses to these as well as to other post-natural, restorative productions as we re-engineer the planet to cope with human-induced disruptions. Without this affective dimension, many of these projects will go un-built or neglected or re-damaged once built. Eco-artists and theorists can help shift our appreciation of reclaimed features from our traditional western demand that nature's "beauty" be pristine, organic, wild, and free of human interference. Such an aesthetic is no longer appropriate. We now must include, among other responses, our sense of the sorrow or despair they evoke, recalling our on-going damage, but also the "redemptive" joy we experience when appreciating their restorative effects. We also must teach ourselves to respond aesthetically to the very environmental processes they either restore or technologically emulate—a complex process aesthetic.

Contemporary artists who produce functioning eco-art and restorative earth works and help define the new aesthetic include Agnes Denes, Michael Singer, Herman Prigann, Alan Sonfist, Mierle Ukeles, Mel Chin, and ecological restoration artists, committees, scientists, and engineers who now are reclaiming and redesigning the earth.

Assessing Functional Lift for Floodplain Restoration Alternatives Using Ecohydraulic Modeling.

Andy Collison*[1], Matt James[2], Brian Haines[1] and Dave Hubbard[2]

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Habitat mitigation has historically placed more emphasis on the *acreage* of habitat restored than the *function* of that habitat. This paradigm is shifting with the emphasis on Functional Lift, where the goal is to maximize the improvements in *ecosystem function* following a project rather than the *area* restored. Functional Lift approaches require us to develop tools to quantify the benefits of different actions so that we can maximize the cost:benefit ratio of alternatives. Working for the California Coastal Conservancy, our team developed a Functional Lift assessment for a mitigation site along Calleguas Creek in Ventura County. Historic levee construction and placement of fill for farming disconnected the site from the creek. Over the last decade, floods have partially breached the levee and eroded the fill to create a natural experiment in floodplain reconnection and plant establishment. By measuring plant diversity and cover along a series of transects and developing a hydraulic model of floodplain inundation at different flood frequencies we were able to develop relationships between hydraulics and ecology. We used these relationships to assess conceptual levee removal and floodplain lowering designs. This allowed us to quantify the Functional Lift in terms of physical processes (change in floodplain inundation frequency) and biological processes (distribution of wetland and upland species) while comparing the outcomes with the associated costs (cost of grading and revegetation). This approach can be improved by accounting for more ecological functions and driving inputs, but it provides an effective starting point on which to build a restoration plan.

Riparian Restoration within Infrastructure Repair Projects: A Case Study.

Jason Drew* and John Heal

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Much of the infrastructure in California is in poor condition or at risk of failure. This includes roads, bridges, culverts and pipelines which cross over, under or through creeks, rivers, wetlands and riparian habitats. The need for infrastructure preservation and rehabilitation presents an incredible restoration opportunity within our creeks and rivers. This discussion of the Via Verdi Culvert Repair Project includes an analysis of the opportunities, constraints and issues associated with integrating restoration actions into infrastructure repair projects. In this case study of a very large culvert collapse on San Pablo Creek, we will present the key questions, considerations and obstacles restoration professionals need to consider when presented the opportunity to integrate restoration into critical infrastructure repair projects. Design of this riparian restoration project included hydrologic and hydraulic analyses, scour analysis, bioengineering considerations and mitigation for fish passage. Another key consideration to be discussed is when and how restoration specialists should be integrated into project design given that most infrastructure projects are typically designed and managed by civil engineers who may be unfamiliar with water resources and restoration concepts. Finally, NEPA, CEQA and environmental permitting are also important processes and their timing and relationship to design will be discussed.

A Quantified Approach to Comparative Functional Assessment of Restored Wetlands.

Wayne R. Ferren Jr.*[1] and Raymond Walker[2]

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In recent years, regulatory agencies have required a functional assessment of restored wetlands in addition to the more traditional approaches of vegetation cover and species lists. To address this requirement and contribute to the process, we developed a Comparative

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Functional Assessment Methodology for wetland restoration and mitigation projects in the context of existing verbal assessments, combining the practical aspects of rapid field assessments together with a quantifiable, query-based methodology. This approach includes a "functional capacity analysis" used as part of the hydrogeomorphic assessment approach (HGM). The result is a numerical value that establishes a rating system for comparing existing conditions with constructed conditions, which are assessed periodically during the monitoring period. As a supplemental analysis, pre-existing and constructed conditions can be compared against an "ideal" proposed future condition, or an existing reference site. We used the ideal standard for the comparison of function at our 30-acre test mitigation site in Sayreville, NJ, and propose here the use of the methodology as an assessment tool for similar projects in California. This methodology provides an organized, documented, and quantified approach to wetland functional assessment in four categories of function: hydrogeomorphic, biogeochemical, habitat, and cultural. A series of analyses are included to assist in the assessment: Estimate of Function, Functional Capacity Index, Site Potential, Integrated Functional Capacity Index, and Summary of Wetland Functional Assessment. Our analyses at the test site demonstrate increases in each category of function during three years of assessment, with a positive trajectory towards the site's proposed functional capacity.

Increased Instream Flows Through Voluntary Transfers of Water Rights.

Tom Hicks[1]* and Derek Poultney[2]

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Resource Renewal Institute's (RRI) *Instream Water Transfers Program* is leading a national campaign to increase instream flows in rivers and streams through federal tax deductions for water right donations. Such an incentive would be analogous to land donations made through conservation easements —a tool that has protected millions of acres in its four decades of use. With over 300 organizations, state and federal agencies, and interested landowners who will most directly benefit from this anticipated IRS Revenue Ruling, it is expected that this conservation tool will be as feasible and successful as the tax incentive for conservation easements and fee title acquisition of permanently protected lands. Remarkably, this water right tax precedent has not already been established. RRI, American Rivers, and several land and water trusts are pressing for an IRS Revenue Ruling, advancing water rights transfer policies, and initiating the first transactions. Land owners know that when it comes to appropriative water rights it is "use it, or lose it." This historic perspective has had the effect of maximizing water diversions to preserve rights at the expense of instream conservation values. If the uncertainty surrounding IRS treatment of water right donations is reduced, water owners will be more likely to donate some or all of their water rights for the benefit of fish, wildlife, and healthy aquatic habitats. Such voluntary water right transfers are strategic alternatives to regulatory action. Other benefits include reduced regulatory conflicts over water allocation decisions and adaptation to changing climactic and precipitation patterns.

Balancing Habitat Restoration and Flood Protection in California's Riverine Systems.

Kevin MacKay

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Historic changes in land use in many of California's watersheds and the construction of flood protection and transportation infrastructure have greatly modified the natural physical and ecological processes of our state's rivers, creeks, and streams, and resulted in the confinement of waterways into narrow channels, alteration of the historic flow regime, disconnection of the river from the adjacent floodplain, loss of riparian and wetland habitats, changes in sediment transport and channel geometry, and reduction in quality and quantity of instream habitat for salmonids and other native fish. In addition, continued development in river floodplains, climate change, and other factors have led to the planning, design, and construction of new flood protection infrastructure to protect homes and businesses from major flood events. However because of federal and state laws protecting riparian and wetland habitat and threatened and endangered fish and wildlife, these projects are required to balance the often conflicting goals of providing sufficient flood conveyance capacity with protecting and restoring geomorphic function, and riparian and aquatic habitat. This presentation will provide an overview of several recent projects that involved balancing providing flood protection for California's urban and rural communities with restoring riparian and aquatic habitat to support salmonids and other native fish and wildlife species —some more successfully than others.

Online Tools for Regional Restoration Planning.

Gerrit A. J. Platenkamp*, Kasey B. Allen, and Eric E. Link

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Recent developments in web-enabled geographic information systems (web mapping) have greatly improved our ability to collaboratively develop regional restoration plans. Restoration of habitats within their landscape context requires

consideration of the topography, hydrology, natural vegetation, land use, and biogeochemical cycling within entire watersheds. Moreover, an understanding of the disruption of ecosystem processes requires that this information be considered over historic time, and evaluation of restoration success requires that it be tracked into the future. Web mapping allows us to make all that spatial information available to a wide array of stakeholders and allows those stakeholders to use that information to participate in restoration site selection and approaches. Web mapping tools such as ArcGIS Online allow the distribution of large amounts of information at varying spatial scales to stakeholders. Also, analytical tools developed in ArcGIS Server can be used by stakeholders to evaluate restoration scenarios. We use data from the Sacramento-San Joaquin Delta to demonstrate how web mapping tools can be used in regional restoration planning. Evaluation of historic and current spatial data at varying scales is used to identify ecosystem modification and associated stressors. Analysis tools implemented in a web mapping system are used to identify restoration sites and scenarios to address these stressors. Web mapping tools represent a significant step forward in making landscape level restoration planning a more collaborative process.

Native Herbaceous Plants for Control of Riparian Noxious Weeds.

Julie Rentner

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In floodplain and riparian ecosystems, often invasive weeds preclude the germination, establishment and succession of native plant communities, hindering restoration efforts and limiting wildlife habitat value. Large-scale riparian restoration efforts have been ongoing in the Central Valley since the 1980's. A hallmark of these restoration efforts is adaptive management: learning by doing, carefully monitoring, and adapting to lessons learned. Earlier methods of riparian restoration included establishment of woody tree species, with little attention paid to understory plant communities. The result of such efforts is often a native riparian forest with a dense understory of invasive herbs. Since 2002, River Partners has been adaptively managing native herbaceous plant communities to preclude re-infestation of restoration sites by invasive weeds such as salt cedar (*Tamarisk* spp.), giant reed (*Arundo donax*), perennial pepperweed (*Lepidium latifolia*) and others. Perennial herbaceous species such as mugwort (*Artemisia douglasiana*), evening primrose (*Oenothera elata*), and creeping wildrye (*Leymus [Elymus] triticoides*) have been shown to successfully out-compete invasive weeds while allowing establishment of native trees and shrubs in restored areas. Treated sites have been subject to disturbances (floods and fires) since restoration and remain resistant to re-infestation of noxious weeds despite ample seed source for reintroduction after such disturbances. This talk presents a case study of over 2,000 acres of floodplain restoration in the San Joaquin Valley and its resistance to weed infestation as a result of establishment of dense and diverse herbaceous communities. The talk includes management recommendations as well as monitoring data from over ten years of adaptively-managed riparian restoration.

Lower Blackwood Creek Habitat Restoration for Water Quality Improvement.

John Zanzi*, Mark Girard, and Scott Eckardt

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

CHAPARRAL RESTORATION—A PARADIGM SHIFT

Chair: **Marcia Narog** *US Forest Service*

Thursday 16 May 10:30a — 12:00p and 1:30p — 3:00p *State Street Room*

Chaparral Restoration: What Do We Know?

Jan L. Beyers*

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At the wildland-urban interface in many areas of southern California, frequent fire has resulted in the conversion of chaparral vegetation to a plant community consisting of a few scattered shrubs and lots of weedy non-native grasses and forbs. Past research at San Dimas Experimental Forest and observations following more recent heavy rains noted that hillslope failure can occur where deep-rooted chaparral has been replaced by shallow-rooted herbaceous vegetation, sometime threatening nearby human development. Interest in restoring chaparral, both for watershed protection and wildlife habitat, has grown. Scientific information on how to reestablish chaparral is scant, however. Considerable restoration research in southern California has focused on coastal sage scrub vegetation, which has been lost to a greater extent than chaparral and is home to federally-listed species. Some work has been done on endemic chaparral plants in the Channel Islands and in limited-extent maritime chaparral on the mainland. Control of non-native grass appears necessary for survival of seeded shrub species, and establishment is also tied to adequate precipitation during the first few years. Mulches have been applied for moisture retention and for nutrient immobilization, which may favor native plants over exotics. Horticultural literature has expanded to include native chaparral species, but it mostly deals with assuring survival of planted container stock under managed landscape conditions. Some help may be found in studies of Mediterranean shrubland restoration on other continents. Further research and experimentation is clearly warranted.

Shrub Recruitment 10 Years Following Fire on Native Chaparral and Type-Converted Watersheds of Southern California.

Bonni Corcoran*, Marcia Narog, and Peter Wohlgemuth

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Following a 1960 wildfire, some areas on the San Dimas Experimental Forest were type-converted from native chaparral to perennial grasses. Located in the San Gabriel Mountains, northeast of Los Angeles, this area presented an opportunity to investigate whether type-converted sites can recover to chaparral when burned with a native seed source nearby. Ten years following the 2002 William's wildfire, vegetation was measured to document chaparral recruitment and recovery in the presence and absence of these historic type-conversions. Six 1 to 3 ha watersheds were used: three type-converted and three native chaparral. Measurements were taken along 10 m line transects: 30 to 40 per watershed. Live plant cover was identified to species and classified by growth type: shrub, sub-shrub, grass, herb, or tree. Ground cover was categorized as bare soil, rock, and litter. Average total live cover for the combined type-converted watersheds was less compared to chaparral. Average type-converted shrub cover was one quarter that found in chaparral. Conversely, average type-converted sub-shrub cover was slightly greater than chaparral. Average type-converted grass cover was 3 times greater than chaparral. Little herbaceous or tree cover was encountered. Bare ground cover was similar between treatments, but litter cover was 3 times greater in chaparral. Disturbances from type-conversion coupled with wildfire inhibited chaparral recovery 10 years after wildfire. Expected recovery from grasses to shrublands did not occur, but longer term monitoring is required. This study verified that proactive measures should be taken to encourage chaparral recovery from previous land management actions such as type-conversion if a chaparral shrubland is desired.

A Chaparral Paradigm Shift.

Marcia Narog

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Chaparral is the dense physiognomic mantel of flammable vegetation stretching from coastal California to inland valleys. While fire hazard can't be ignored, we need to shift our focus from chaparral as a disposable and dangerous vegetation type to one appreciated for its fundamental values and aesthetics. Advocates recognize this drought tolerant vegetation provides many wildland and urban services from homes for California's biodiversity to hill-slope stability for urban sprawl. Historically, chaparral management focused on getting rid of it to improve recreation, grazing, watersheds, and reduce fire hazard. We now realize chaparral removal can lead to undesirable effects including invasive species, increased erosion and closer interval fires. Such trends will persist with continued disturbance and climatological changes. To improve the current "state of the chaparral" we must rethink its place in the landscape and learn how to assess its true value. A need is emerging for how to restore vanishing chaparral communities. Ideally, effective chaparral management should improve disturbance resilience. To accomplish this, we must determine such things as: what type, how much and where chaparral has been lost, who or what incurs damages from its absence

and whether different stand ages have unidentified, mutable or fixed worth. Subsequent considerations would address why, how and where chaparral requires modification, conservation and restoration. Because chaparral restoration has been mostly ignored, species, site and landscape level techniques for successful propagation are needed. Wildland restoration may seem an unwieldy task but is pivotal to the chaparral paradigm shift from removal and replacement to proactive conservation and restoration.

Airborne Imaging of Fire and Postfire Environments to Understand Fire Effects.

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Fire Severity Effects on Chaparral Recovery on the Los Padres National Forest.

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The Los Padres National Forest (LPNF) ranges from Monterey County to western Los Angeles County, CA. Sixteen chaparral alliances cover 56,700 Ha (1.4 million ac) on the LPNF. The most widespread alliance is lower montane mixed chaparral, CQ, growing on 311,609 Ha (770,000 ac). On LPNF, 5500 fire starts were recorded since 1910, with 350+ fires spreading to over 120+ Ha (300 ac). Potential vegetation recovery after fires is constrained by available vegetation sources (resprouters or seed bank), soil productivity, fire severity or vegetation mortality, and postfire disturbance events which reset the vegetation recovery. FS mapping of fire history since 1910, fire severity areas since 1990, and digital aerial photographs allow comparisons of fire effects and postfire vegetation recovery. Vegetation adaptations and soil productivity delineate recovery potential. For example, in 2006, fire history indicated that the median value for CQ's fire return interval (FRI) was 40 years. In 2007, two large fires burned 6070 Ha (300,000 ac). Mortality differed with chaparral vegetation type and FRI, with 15,000 acres of sagebrush (SS) and buckwheat (SB) alliances unchanged by fire. However, all alliances had increased mortality with longer FRI, which in turn affects vegetation recovery rates. Comparison of the severity effects of fires on the chaparral alliances, the landscape factors leading to increased mortality, and recovery metrics will be explored.

Forest and Shrubland Restoration in the Mediterranean Basin.

V. Ramon Vallejo

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The composition and dynamics of Mediterranean-basin forests and shrublands is largely determined by land use history and fire regime. Most shrublands in the Mediterranean basin constitute successional stages after perturbation. The landscape is dominated by a changing mosaic of formations ranging from shrublands to woodlands/forests, where transitional formations are common. In this context, sclerophyllous shrubs and trees, characteristic of late successional formations, are vigorous resprouters that regenerate very fast after fire, whereas colonizer species are mostly obligate seeders with relatively slow plant cover regeneration rate after fire. In addition, these seeders accumulate very hazardous fuels in 1-2 decades after perturbation. Old-field succession very often gives way to fire-prone shrublands, with or without pines.

Land abandonment has been widespread in Southern Europe since the middle of the 20th century and is expected to continue so in the coming decades. The challenge is to manage these ecosystems to reduce fire risk, and to promote the recovery of late successional, more fire-resilient shrublands and forests.

We have developed post-fire land restoration strategies in order to reduce ecosystem degradation risk and to assist the recuperation of late successional ecosystems. These include early assessment of short-term post-fire degradation risk and long-term ecosystem recovery, and the development of techniques to mitigate soil erosion and to restore vulnerable ecosystems. Sclerophyllous shrubs and trees are planted in fire-prone shrublands dominated by seeders, in order to reduce fire hazard and to increase ecosystem

continued

resilience. Plantation technologies focus in reducing transplanting shock and overcoming the first post-planting drought period.

Lessons Learned: Attempting Restoration in Type Converted and Heavily Disturbed Chaparral.

Katie VinZant* and Janet Nickerman

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A wide range of disturbances including fire, recreation, utility corridors, and invasive plants have had a significant impact on the native chaparral habitats of the Angeles National Forest. Degradation has been especially prevalent in the foothill areas of coastally influenced chaparral and desert transition chaparral on both the south and north sides of the forest respectfully. These impacts have led to the recent planning, implementation and monitoring of a wide variety of restoration techniques across the forest. Restoration techniques have included imprinting, pitting, hydroseeding, container planting and aggressive weed control with a variety of results. The largest factors influencing these results are adequacy of planning, timelines, weather patterns, hydrology and soil conditions, pre-project invasive plant infestations, availability of materials and personnel, and as always, cost. The highest performing restoration sites appear to be those that either had a low presence of non-natives beforehand or had aggressive weed control in the first two/three years of restoration, combined with the use of enough genetically appropriate, early seral native plants introduced to the site as container plants at the correct time in the early fall, watered consistently using deep pipe irrigation.

EMERGING SCIENCE — STUDENT RESEARCH

Chair: **Andrew Rayburn, PhD** *Dept. of Plant Sciences, UC Davis*

Thursday 16 May 1:30p — 3:00p *Flying A Studios Room*

Reconstructing the Long-term Record of Coastal Marsh Dynamics in California.

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With recent projections indicating that sea levels could rise by up to 1m in California over the next century (Committee on Sea Level Rise in California, Oregon, and Washington, 2012), plans for restoring coastal wetlands must incorporate an understanding of how coastal marshes will respond to changing sea level. While computer models provide one method for predicting marsh stability, another method reconstructs the past sediment and ecological dynamics recorded in the marsh sediments themselves. We obtained sediment cores from Tijuana Estuary, Mugu Lagoon and work is in progress at a number of other sites this winter and summer. Radiocarbon dating on macrofossils from Tijuana Estuary returned an age of 1610±30 BP, indicating a gross accretion rate of 0.08 cm yr^{-1}. This result is congruent with a survey of literature revealing a range of accretion rates from 0.07-0.14 cm yr^{-1} in Southern California coastal marshes. Using pollen, macrofossils, and continuing our research up the California coast, we aim to create a regional reconstruction of the physical and ecological responses to Holocene sea level changes in order to better understand how these ecosystems have adapted to sea level rise in the past and inform restoration plans for the future.

Summer Fog Exclusion in *Artemisia californica.*

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The coastal sage scrub plant community (CSS) is found from San Francisco to San Diego along California's coastline, and is prominent near Santa Barbara. *Artemisia californica*, also known as California Sagebrush, is one of the dominant species in the CSS community. CSS frequently experiences low precipitation during the summer, leading to drought conditions. During this time, however, there is an increase in seasonal fog. Seasonal fog can condense on plant leaves and drip into the soil (fog drip), providing an additional source of water. This two year study examined the effect of excluding fog drip from the water budget of *A. californica*, by measuring both live fuel moisture and xylem pressure potential during the summers of 2011 and 2012. Fog drip was excluded with the use of plastic tarps beneath treatment plants. There was no significant difference in the live fuel moisture or xylem pressure potential between the plants which received fog drip and those which did not. An asymptotic relationship was found between the live fuel moisture content and xylem pressure potential across both summers.

Effects of Riparian Restoration on Native and Invasive Aquatic Plants.

Emily Peffer

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Riparian restoration projects are becoming increasingly common in California. While restoration has been shown to benefit multiple animal species (e.g., fish, birds), the effects of restoration on aquatic plant communities are rarely addressed. I conducted two experiments on how riparian restoration practices, by altering instream shade levels through removing or restoring overstory riparian trees, could affect the establishment, growth, and competitive interactions of two aquatic plant species- a native, *Elodea nuttallii* (western waterweed), and an invasive, *Myriophyllum spicatum* (Eurasian watermilfoil). Both experiments were conducted in artificial stream channels at UC Davis. In the first experiment, I found that both species were able to establish when planted separately (not in competition) in four different shade levels (0, 30, 60, and 90% shade), and that the invasive grew larger than the native in all treatments after seven weeks. However, greater shade negatively impacted growth of the invasive more than the native. The second experiment examined competitive interactions of the same two species under four shade treatments crossed with two competition treatments: the native and invasive planted at the same time, or the native planted five weeks before the invasive. The growth rate of the invasive was not significantly affected by planting the native earlier, suggesting that establishing native aquatic plants after stream restoration may not prevent the invasion of nuisance species. Shade played a greater role in reducing growth of the invasive, and perhaps even facilitated the native at intermediate levels; therefore, restoring shade to streams may benefit natives while hindering invasives.

Rewilding Central Valley Field Margins with Native Forbs.

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In recent years, native forbs have taken more of a center stage in restoration work, especially because of their role in providing pollinator services in agricultural areas. This study evaluates the success of different native forb mixes and seeding rates using restoration goals (e.g., percent cover), pollinator services (e.g., floral resources), and shared goals (e.g., cost-effectiveness and diversity). At six hedgerow sites in Yolo County, we planted three seed mixes at three different densities in nine 8m^2 blocks. From 2008-2010, we recorded germination success, percent cover, and flowering rates. We found that site placement and seeding rate, not mix type, were the two most important determinant factors. The two highest seeding rates produced the most germinants, cover, and floral resources, but the highest seeding rate was consistently the most expensive (cost per percent cover). We also found that the diversity and cover of the plantings changed significantly across time; most species declined significantly by the second year after planting. Three species, *Eschscholzia californica*, *Grindelia camporum*, and *Phacelia californica*, were the most cost-effective throughout the study. However, they were not always the most prolific bloomers, an important consideration when providing pollinator services. This study's findings are corroborated by other similar Central Valley studies varying forb mixes and examining actual pollinator visits. All of these findings together highlight the tradeoffs between restoration and pollinator services goals that land managers and private growers must make when deciding which species to plant, in what type of mix, and at what seeding rate.