SERCAL's 17th Annual Conference

A View of Restoration from the Range of Light

Conference Program

"... It seemed to me that the Sierra should be called, not the Nevada or Snowy Range, but the Range of Light. And after ten years of wandering and wondering in the heart of it, rejoicing in its glorious floods of light, the white beams of the morning streaming through the passes, the noonday radiance on the crystal rocks, the flush of the alpenglow, and the irised spray of countless waterfalls, it still seems above all others the Range of Light."

— *John Muir* 1912

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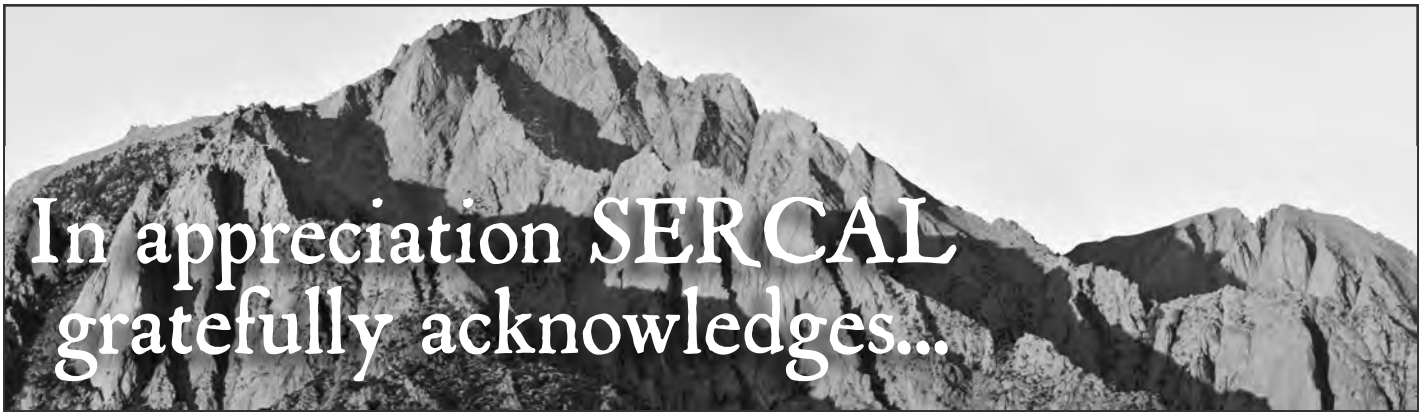

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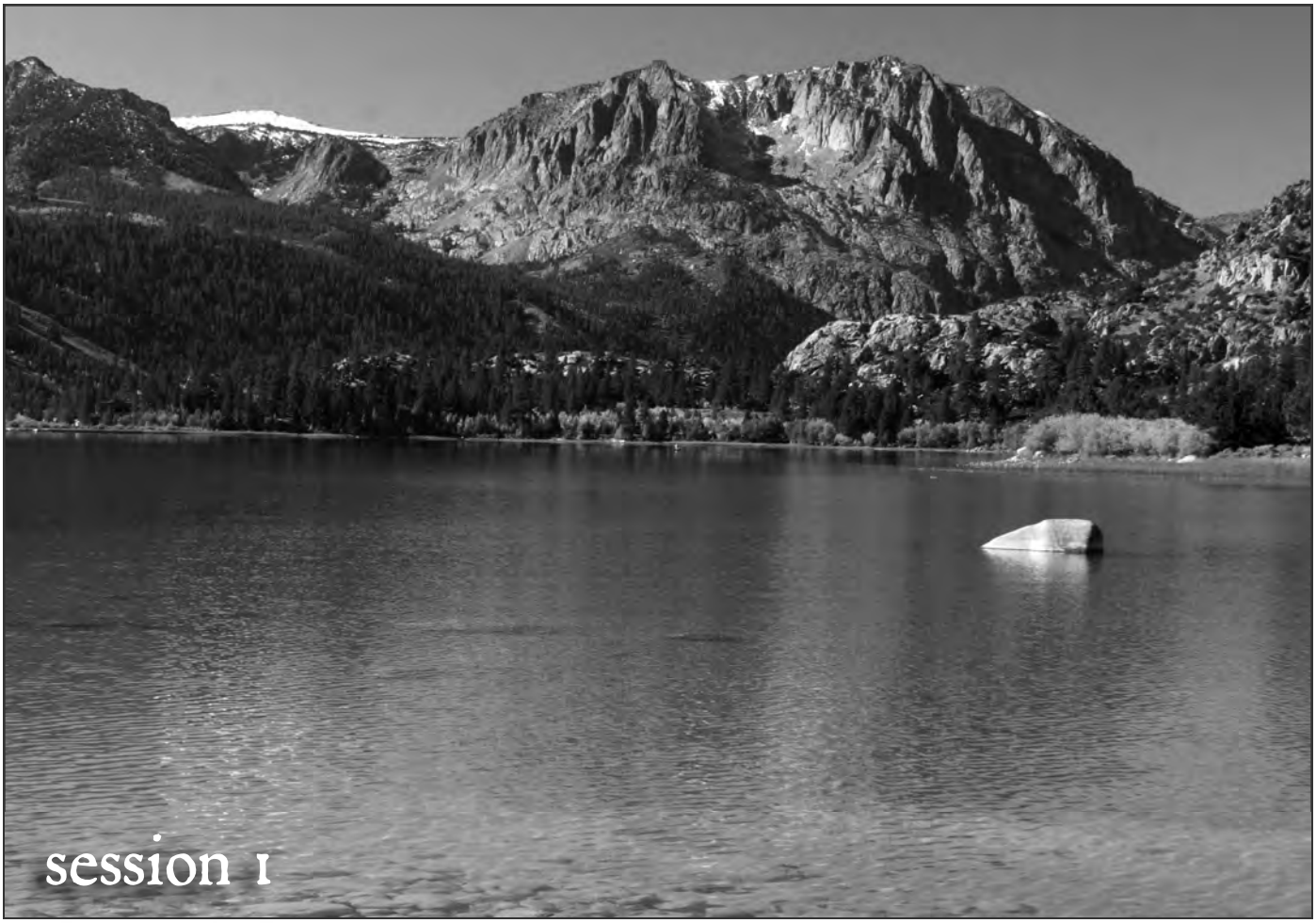


Soil and Restoration: Starting at the Source

Chair: **Michael Hogan** *Principal, Integrated Environmental Restoration Services, Inc.*

Soil Influences on First-year Plant Establishment in Restoration of Retired Agricultural Land. *Margaret Bornyasz*[*1], *Jackie Higgins*[1], *Mari (Schroeder) Quillman*[1], *and Doug Sprague*[2]. [1]*ECORP Consulting Inc, 3914 Murphy Canyon Road, Suite A232, San Diego 92123.* [2]*Vulcan Materials Company–Western Division, 3200 San Fernando Road, Los Angeles 90065.*
mbornyasz@ecorpconsulting.com

In the winter of 2009, Vulcan Materials completed installation of a 45-acre Riversidean sage scrub restoration project at the Colton Dunes Preserve, San Bernardino County, CA. Dune formations throughout the mitigation bank property provide habitat for the endangered Delhi sands flower-loving fly (*Rhaphiomidas terminus abdominalis*; DSFLF) and support other special status species. Prior to 2009, a portion of the property consisted of an agricultural field that had been actively farmed since before the 1930s. The recently retired field supported a dense mosaic of near monotypic stands of non-native herbaceous species. The purpose of the restoration project is to remove non-native vegetation and create native plant habitat. During initial planning stages, 13 exposed soil profiles (depths ranging from 53 to 100 inches) were characterized and a subset of soils was sampled for lab analysis. Botanical monitoring transects were intentionally stratified by soil type. Though the entire area received the same hydroseeding treatment, variations in cover and species distribution of first-year species appear to correspond to soil types. Overall percent cover varied significantly between locations and was below 50% in areas where sandy loam soils persist in the solum and well above 50% where coarser materials (loamy fine sands and fine sands) dominate. Similar patterns exist with shrub height and percent shrub cover; height and cover were greater in the coarser solum. Dominant species varied between transects and a mosaic pattern similar to what was observed in pre-restoration conditions has developed, suggesting soil microhabitat conditions occur and influence restoration results.

Infiltration and Rainfall Capture in Perennial Versus Annual Grass Stands. *Vic Claassen*[*1], *Matt Curtis*[1], *Eric Rider*[1], *Ryan O'Dell*[1], *Arek Fristensky*[1] *and Stefan Lorenzato*[2]. [1] *Department of Land, Air and Water Resources, UC Davis, 95616.* [2]*California Department of Water Resources.*
vpclaassen@ucdavis.edu

Invasive annual grasses are generally viewed as being more shallow rooted than perennial grasses. If so, the soils that the grasses generate and support would also

be expected to be shallower, creating a reduced infiltration capacity under the annual plant community. We measured infiltration in paired annual and perennial grass stands in northern California and found the perennial grass stands to be significantly higher. The field data are then used to estimate landscape level effects of vegetation conversion from annual rangelands to perennial grassland communities.

Revegetation for Slope Stabilization and Erosion Control in California Mine Reclamation. *Leah Gardner. Department of Conservation, Office of Mine Reclamation, 801 K Street, MS 09-06, Sacramento 95814.* **Leah.Gardner@conservation.ca.gov**

Revegetation offers the best long-term, sustainable solution to stabilizing slopes and preventing soil erosion and sedimentation on lands disturbed by surface mining. The self-perpetuating revegetated cover intercepts raindrops and reduces the velocity of surface runoff, transpiration removes water from the soil, and plant roots help bind the soil particles together. All of these benefits provide tensile strength to slopes and decrease the incidence of erosion, slumping, and slope failure. Established native plants blend the site with the natural surroundings and provide ecosystem services, such as supporting microbial and chemical processes and biotic interactions. Examples of revegetation successes and failures on mined lands throughout California will be used to explain the techniques of successful revegetation in a variety of ecosystems. Requirements for revegetation, topsoil management, and erosion control under SMARA (California's Surface Mining and Reclamation Act) will also be discussed.

Microbial Community Composition and Stability of Disturbed Soils in the Lake Tahoe Basin. *A. B. Collins & Mark E. Grismer*. Soils & Biogeochemistry Graduate Group, UC Davis,1 Shields Ave., Davis 95616.* **megrismer@ucdavis.edu**

While the influence of soil physical and chemical characteristics on erodibility have been examined on disturbed soils across the Tahoe Basin, the soil microbiological component remains poorly understood. We assessed the type of microbial groups and their influence of on soil stability/erodibility using rainfall simulation and microbial lipid analysis. We also consider the relative success of these restoration treatments, not only in terms of hydrologic parameters, but also as a function of microbial community structure. Study sites included roadcuts and ski runs having parent material of either granitic or volcanic origin. Treatment plots at each site contained a combination of soil loosening and erosion control amendments. Phospholipid Fatty-acid Analysis (PLFA) was conducted on samples from all plots to determine total microbial biomass, bacteria, gram-negative bacteria, gram-positive bacteria, actinomycetes, fungi, AM fungi, and stress indicator biomarkers and used as "fingerprints" or ecological indicators. Microbial communities differed by treatment. Compost treatment sites generally contained the most bacteria, actinomycetes and AM fungi, and the least fungi. Native sites contained the most fungi and the least AM fungi. The occurrence of runoff was found to be related to greater levels of gram-negative bacteria and mono-unsaturated: saturated lipids at all locations. Increased infiltration rates were associated with increased total microbial biomass, and on roadcuts were specifically associated with fungal biomass. Using PLFA and multivariate statistical methods, Centroid plots, expressed in two-dimensional space, were developed to graphically illustrate relative similarity of microbial community structures. The results showed that PLFA fingerprints differed from location to location, but at all locations native plots were significantly different than treated plots, and furthermore, that all treated plots were more similar to one another than to native plots.

The Importance of Soils and Landscape Position in Determining the Desired Habitat Condition . *Margot Griswold* and Melissa Riedel-Lehrke. NewFields AER, 2116 Arlington Ave., Ste 301, Los Angeles 90018.* **mgriswold@newfields.com**

The successful creation of transmontane alkali meadow habitat on the dry Owens Lake provides insights into the importance of soil sampling and soil monitoring when attempting to establish a specific habitat in drastically disturbed conditions. Pre-implementation soil sampling and consideration of landscape position of the project in relation to soil remediation prescriptions were essential to provide conditions to establish the desired habitat. Specifically, soil monitoring was used to determine when leaching of salts was sufficient to seed and plant. The use of a pilot project was fundamental to developing the specifications for the plant species composition and implementation specifications for the site conditions. A contrasting project shows how lack of any pre-project soil testing resulted in several unsuccessful attempts to establish upland habitat. Even when soils were tested, it was difficult to specify a cost effective soil remediation prescription or to find plant species to fit the site conditions once the slope had been finished and the project contractors were long gone. The site is a steep cut slope that reached old marine terrace soil with a low pH of 3 and relatively high Ec of 8. The landscape position makes leaching difficult, and soil buffering makes sustainable change to pH difficult. Temporary irrigation with lime water allowed establishment of saltbush plants as a limited solution to the revegetation of this slope. Had the site been tested prior to final design, a more sustainable solution might have been possible.

Restoring Habitat for California's Sensitive Wildlife Species:

Lessons on Integrating Restoration and Wildlife Ecology

Chair: **Max Busnardo** *Senior Restoration Ecologist, H.T. Harvey & Associates*

Effects of Rare Habitat Restoration on Songbirds and Small Mammals: Challenges and Results. *Sandra A. DeSimone* and Scott E. Gibson. Audubon California's Starr Ranch Sanctuary, 100 Bell Canyon Rd., Trabuco Canyon 92679.* **sdesimone@audubon.org**

At Audubon's 4,000-acre Starr Ranch Sanctuary in southern California, we monitor rare habitat restoration (coastal sage scrub) and how the restoration process affects songbirds and small mammals. In 2004 we selected a restoration site and a matched pristine site (for size, elevation, aspect, and slope). During the wet and dry season annually we trap small mammals over three consecutive nights and do songbird point counts in each site. We also spot-mapped songbirds over a restoration chronosequence in 2006, but concurrent small mammal trapping was ruled out due to relatively intense impacts and insufficient trap supply. In 2007 we initiated annual songbird area searches April - July in matched pair sites. Spot mapping data indicated an increasing trend in songbird species richness over the chronosequence from baseline through year eight of restoration. By the fourth season of restoration, songbird species richness from breeding season area searches in the restoration site was 50% lower than that of the matched pristine site. However, point count data from the same year indicated overall annual species richness in the restoration site was 25% higher than the matched pristine site. Small mammal species richness in the fourth season of restoration increased from baseline, but was still lower than the pristine site. Challenges include uncertainty of restoration success, which is associated with annual precipitation. We added two more matched pair sites in 2006, but dropped both after two seasons of unsuccessful restoration. A further challenge is balancing power and rigor with efficiency, costs, and impacts.

Restoration of Nesting Habitat for Cactus Wrens in Orange County, California. *Megan Lulow*[1], Jutta Burger[1], Susan Anon[1], Yi-Chin Fang[1], Quinn Sorenson[1], Alyssa Penacho[1], Robert A. Hamilton[2], an Michael O'Connell[1]. [1] Irvine Ranch Conservancy, 4727 Portola Parkway, Irvine 92620. [2] 316 Monrovia Avenue, Long Beach 90803.* **mlulow@irconservancy.org**

The coastal Cactus Wren (*Campylorhynchus brunneicapillus sandiegense/anothonyi*) inhabits southern cactus scrub in coastal southern California. It is a California species of special concern and one of three target species in the Central-Coastal Orange County Natural Community Conservation Plan. For more than two decades, coastal Cactus Wren populations have been declining rapidly, likely because of habitat loss and fragmentation due to development and large-scale fire events. The purpose of this project is to augment nesting habitat devastated by a catastrophic wildfire covering approximately 6,000 hectares of the Irvine Ranch Natural Landmark. We are implementing two approaches to increase available nesting habitat for the Cactus Wren. First, over the last two years we designed and installed three models of "artificial cactus" in 23 locations currently occupied by Cactus Wrens to test their suitability as nesting structures. Second, we installed over 360 *Opuntia littoralis* at each of 40 sites across five regions of the burned area using approximately 15,000 single cactus pads, 500 multiple pad-links, and 150 large, potted transplants. Restoration locations were strategically selected utilizing a combination of GIS queries, based on the location of Cactus Wren pairs and proximity to remnant

cactus, and ground surveys. Restoration sites varied in patch size, cactus pad density, and cactus size to determine best practices for restoration of *Opuntia littoralis* and coastal Cactus Wren habitat. Use of artificial nests by Cactus Wren, the survival and growth of different cactus propagule types, and an analysis of man hours necessary for implementation will be presented.

An Interdisciplinary Approach to Conservation Bank Restoration and Management Planning for Delhi Sand Flower-loving Fly. *Mari (Schroeder) Quillman*[*1], Doug Sprague*[*2], and Margaret Bornyasz*[1] . [1]ECORP Consulting Inc, 3914 Murphy Canyon Rd., Suite A232, San Diego 92123. [2]Vulcan Materials Company–Western Division, 3200 San Fernando Road, Los Angeles 90065.* **mquillman@ecorpconsulting.com**

The Delhi sands flower-loving fly (*Rhaphiomidas terminus abdominalis*; DSFLF; Endangered) is associated with partly or wholly consolidated aeolian sand dune complexes in Riverside and San Bernardino Counties. Its habitat requirements include fine, sandy soils for the subterranean early life stages, adult nectar sources, and adult feeding, breeding, and perching areas. Vulcan Materials Company established a 150-acre Conservation Bank for this species in 2005. The dune formations throughout the bank are occupied by DSFLF. However, a 43-acre fallow agricultural field in the center of the bank was unsuitable habitat for DSFLF. Restoring the agricultural field and enhancing the existing habitats for the DSFLF became the focus of an interdisciplinary, collaborative workshop hosted by Vulcan and UC Riverside. The focus of the workshop was to determine management strategies that would allow for re-colonization of the agricultural field and would promote an increase in the population of DSFLF. The workshop was attended by entomologists, insect ecologists, research scientists, restoration specialists, geologists, bank management staff, and regulatory representatives. The workshop covered topics such as known information, research goals and needs, research priorities, regional conservation strategies, regional reserve design, restoration in a historical context, and restoration and research priorities specific to the bank. The resulting of the collaborative effort have now been incorporated into the management strategies for the Conservation Bank.

Plant and Wildlife Ecology Collaboration for Effective Riparian Habitat Restoration. *Julie Rentner. River Partners, 1301 L Street #4, Modesto 95354.* **jrentner@riverpartners.org**

Riparian brush rabbit is a federally-endangered subspecies of brush rabbit that inhabits stream-side areas in the northern San Joaquin Valley and the South San Joaquin / Sacramento Delta. Known from just one remnant population, this terrestrial species is threatened by catastrophic floods which occur when the regional flood control system is overwhelmed (recently in 1997 and 2006). To abate future threat of extinction due to flooding, River Partners has teamed with the U.S. Fish and Wildlife Service and the Endangered Species Recovery Program at California State University Stanislaus to develop habitat restoration strategies that efficiently create and protect precious high ground areas in the floodplain at the San Joaquin River National Wildlife Refuge, the primary site for reintroduction of captive bred riparian brush rabbits. Strategies for restoration include vegetating abandoned levee sides with dense brush, constructing and vegetating elevated mounds that are protected from erosion by well-placed clusters of willows acting as 'green rip-rap', providing strategic movement corridors to guide rabbits to high ground as flood waters rise, and enhancing older restoration sites to promote dense understory growth favored by brush rabbits for cover. Monitoring performed by ESRP shows that rabbits are using vegetated levees and mounds during non-flood times, thus increasing their habitat value beyond mere flood refugia.

California Tiger Salamander and California Red-legged Frog Habitat Creation, Enhancement, and Restoration in Eastern Alameda Count. *Karen Verpeet*, Pat Reynolds, Julie Klingmann. H.T. Harvey & Associates, 983 University Avenue, Building D, Los Gatos 95032.* **kverpeet@harveyecology.com**.

In 2003, H.T. Harvey & Associates initiated a mitigation program for California red-legged frogs (CRLF; *Rana aurora draytonii*) and California tiger salamanders (CTS; *Ambystoma californiense*), including the establishment of conservation areas, among them the 267-acre Northern Drainage and 394-acre Lin Livermore sites. At the Northern Drainage we designed 3 CTS breeding ponds, restored 3 stream channel sites, and excluded cattle from the riparian corridor. At Lin Livermore, we created 19 seasonal ponds to establish breeding habitat for the CRLF and CTS . The mitigation design and conservation area management involved close collaboration between wildlife ecologists and restoration designers to develop appropriate breeding hydrology in the created ponds and suitable aestivation habitat in the surrounding uplands. Both conservation areas are specifically managed for target wildlife species. We monitor and control non-native pest plants, control amphibian larvae predators, and manage livestock grazing to maintain grass cover at appropriate levels for the target wildlife species. We began monitoring amphibians in 2004 and results indicate establishment of more extensive populations than expected with breeding and colonization of new ponds and pools. In 2006 we estimated the larval CTS population at Lin Livermore to be approximately 29,000. During the extensive restoration design process and our continued management and monitoring activities, we have learned more about the challenges of maintaining open water habitat in sites colonized by cattails and the difficulties of developing success criteria that allow resource agencies to sign off on high value sites that don't meet a singular success criterion.

Watershed-Scale Restoration of Aquatic Communities

Chair: **Mike Liquori** *Principal, Sound Watershed Consulting*

Assessing and Minimizing the Effects of In-stream Mining on Restoration. *Fred W. Gius. California Department of Conservation, Office of Mine Reclamation, 801 K Street, MS 09-06, Sacramento 95814.* **fred.gius@conservation.ca.gov**

In-stream mining operations provide an important source of aggregate to the construction industry and can help maintain flood control. In California, in-stream mining operations are regulated in part by the Surface Mining and Reclamation Act (SMARA) which requires mining operations to control channel degradation and to evaluate channel elevations and bank erosion annually. The extraction of sand and gravel from California's river systems can affect flow, sediment sources, and sediment transport, and may result in changes to the channel morphology. Primary in-stream mining methods used in California include stream bed skimming, in-stream pit mining, and floodplain pit mining. Effects from these mining methods can include aggradation, channel incision, headward erosion (headcutting), bank erosion, channelization, loss of low flow channel confinement, disrupting bed armor, pit capture, loss of soil development on floodplains, lower groundwater levels, loss of riparian vegetation, loss of wildlife habitat, and damage to infrastructure. These effects can be minimized or eliminated through proper planning (including the development of regulations or oversight committees), assessments, and monitoring. One strategy, called adaptive management, consists of limiting extraction rates to an amount less than the estimated sediment supply from upstream sources. Assessments typically include reviewing survey data to estimate the amount of recruitment and then limiting annual extraction rates. Long-term monitoring may be necessary through the implementation of a watershed-scale adaptive management plan because some effects may not be immediately obvious since they are dependent on high flow conditions.

Quantifying the Hydroecological Effects of Stream Restoration. *Chris Hammersmark, Ph.D., P.E. cbec, inc. eco engineering, 1255 Starboard Drive, West Sacramento 95691.* **c.hammersmark@cbecoeng.com**

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

Assessing the Anthropomorphic Influence on the Natural Hydrograph and Associated Ecological Implications for the Walker River, Nevada. *M.K. Liquori. Sound Watershed Consulting, 2201 Melvin Road, Oakland 94602.* **mike@soundwatershed.net**

The Walker River has served as a major water source for farmers within the Walker River Basin for nearly 150 years. Between 1958-2007, 55%-131% of natural inflows have been diverted from the entire river for irrigation and other anthropogenic

uses, while the remainder of the water is delivered to Walker Lake or lost to evapotranspiration and groundwater. These diversions and other land-use practices have locally altered the river geomorphology, however the ecological effects are less clear. This study examines whether the river has retained its functional ecological integrity, despite these diversions, based on 11 specific alteration types for 5 key factors describing the Natural Flow Regime: timing, rate of change, frequency, magnitude, and duration. In terms of these factors, we have compared the measured flow regime and estimations of the natural flow regime (corrected for diversions, storage, and losses) in several reaches of the watershed above Wabuska for the years 2001 to 2007. As a whole, 78% of the measures were classified as low or no observed alteration. Generally, the timing of flows have been affected minimally by the diversions at each observed reach. Hydrograph peaks occur at the same time in both regimes and baseflows are consistent with the natural variation in low flows. Low flow durations are typically augmented slightly in the current flow regime, but usually by less than two weeks. For most reaches the snowmelt peak duration was shortened by only a few days, and other peaks (e.g. rain-on-snow) where minimally effected. In all years the rate of change of discharge with respect to time was consistent with rates observed in the natural flow regime on the annual scale, and minimal variations were seen on the storm scale in 2003 (dry) and 2005 (wet). The temporal variation in hydrograph peaks was highly consistent with the natural regime in all years. Discharges during low flow periods saw slight stabilization on the scale of a day or two. The duration of peak flows and baseflows are both highly consistent. The most significant impacts include 1) a reduction in magnitude of the peak flows at most reaches, with the scale of reduction increasing downstream, 2) the virtual loss of the snowmelt peak at Wabuska during drought years, and 3) modest reductions in flow during the months immediately preceding the snowmelt peak in a few reaches during some years. A significant portion of the effects at Wabuska appear to be influenced by substantial losses to groundwater in Mason Valley. Overall, the river appears to have retained much of the integrity of the natural flow regime according to these factors.

Rapid Geomorphic Assessment in Support of Riparian Restoration: Comparison of Two Methodologies and Presentation of a Case Study on the Napa River. *Jeff Peters[1]* and Kevin Mackay[2]*. [1]ICF International, 630 K Street, Suite 400, Sacramento 95814. [2]ICF International, 2841 Junction Avenue, Suite 114, San Jose 95134.* **jpeters@jsanet.com kmackay@jsanet.com**

Geomorphology plays a significant role in understanding riverine processes. As such, prior to conceptual design for riparian restoration efforts, a proper understanding of geomorphic characteristics that influence habitat suitability and quality for fish over a channel reach or valley segment must occur. However, limited funding or an adequate budget for necessary studies is often available. Accordingly, this presentation focuses on rapid data collection procedures to aid in a solid understanding of geomorphic characteristics prior to restoration design. Nine characteristics, or indicators, are typically collected. These include: substrate composition and embeddedness; bank instability and bank characteristics; pool, riffle, and run frequency; large woody material influence; gravel bar development; bankfull width and depth; degree of incision and stage of channel evolution; channel pattern; and upper watershed sediment input. A somewhat recent data collection protocol, Surface Water Ambient Monitoring Program (SWAMP), also requires the collection of many of the aforementioned indicators. Past experience with restoration efforts suggests that a combination of the two methods is preferred. The presentation will provide examples of projects where geomorphic assessments were used to identify characteristics that limited habitat quality use for native fish, and to develop treatments for enhancing habitat to support various life history stages.

Application of Eastern Sierra Riparian Monitoring Studies to Stream Restoration. *Edith Read. E. Read and Associates, Inc., 368 South Grand St., Orange 92866.* **ereadconsult@earthlink.net**

We are monitoring existing riparian vegetation communities as part of Southern California Edison's monitoring program for their eastern Sierra Nevada hydroelectric projects. While studies are still ongoing, some patterns have emerged over the past 20 years that are relevant to restoration: 1) impacts of water diversion on riparian communities vary by stream reach — in some cases, impacts of recreation uses overwhelm impacts of water diversion; 2) vegetation along upper elevation, glacial valley streams is limited more by light, sediment, and floodplain width than water availability; 3) vegetation along lower elevation, alluvium-dominated streams is limited by depth to groundwater and stream flow, with species such as willows and cottonwoods favoring groundwater depths less than about five meters; 4) stream gradient and distance from the stream affect soil moisture response to stream flow and development of herbaceous communities; 5) seedling recruitment is limited by stability of fine sediment deposits along the stream edge; 6) species richness is concentrated in the herbaceous component of the riparian community, which is generally the most difficult to restore and protect from human impacts compared to traditional restoration targets such as willows and cottonwoods. Collectively these studies highlight riparian diversity and a view that not all sites are equally restorable to the same type of community on the same timeline.

Geomorphic Restoration and Monitoring Results of Angora Creek Stream and Flood Plain Restoration Projects. *Cyndie Walck* and Nathan Shasha. California State Parks, Sierra District, PO Box 16, Tahoe City 96145.* **cwalck@parks.ca.gov**

CSP has completed restoration projects on 2 reaches of Angora Creek, the largest

continued

tributary to the Upper Truckee River. The creek was locally channelized or straightened, resulting in channel incision and loss of geomorphic function as well as loss of meadow habitat. The goals of both of the restoration projects were to restore geomorphic function and the related riparian ecosystem. In 1997 CSP completed construction on the lower-most reach of Angora Creek. The creek had been channelized to de-water the meadow for previous dairy operations, and a golf course built on the lower reach. The meadow channel was restored by enhancing remnants of the historic channel, and removing dams and drainage ditches. An entirely new channel was designed through the golf course using a geomorphic approach and biotechnical techniques. A second reach of Angora creek was restored in on Angora Creek in 2002. A section of Angora Creek was captured along a recently constructed sewer alignment, causing it to flow in a straight line directly on top of the sewer, leading to incision and meadow drying. CDPR restored the stream by constructing a new meandering channel, a shorter steep section at the downstream property boundary, and filling the sewer gully. Both projects resulted in construction of a new sinuous channel which mimics the pre-disturbance channel, reconnecting the meadow floodplain. This in turn raised the groundwater elevation, increased overbank flow frequency and duration, and improved meadow vegetation. These changes are inferred to increase fine sediment deposition and nutrient removal as well as to improve meadow habitat. The monitoring efforts demonstrated that the broad goals were achieved through monitoring of fairly low cost measurable objectives. CSP approach was to concentrate monitoring on the more easily measurable physical parameters such as geomorphic characteristics, water table and vegetation and to infer those results to have beneficial impacts on other aspects of the habitat and water quality that are more difficult, expensive, and require longer time frames to monitor.

Grazers and Grazing:
Tools from Another ERA for Use in Meeting Modern Landscape Management Objectives

Chair: **David B. Kelley** *Principal & President, Kelley & Associates Environmental Sciences, Inc.; President, Tuscan, Inc.*

Adventures in Establishing a Native Plant Population (Butte County Meadowfoam, *Limnanthes floccosa* ssp. *californica*) in a Vernal Pool Ecosystem: The Essential Tools—Grazing, Weather and Luck. *David B. Kelley*[1,2], Roderick L. Macdonald[2] and Steven N. Talley[3]. [1]Kelley & Associates Environmental Sciences, Inc., 20 E. Baker Street, Winters 95694. [2] Tuscan, Inc., 20 E. Baker Street, Winters 95694. [3] 4300 Eucalyptus Road, Fair Oaks 95628.* **dbkelley@jps.net**

The Tuscan Preserve in northern Butte County, California, was established in 1991 to protect approximately 11 acres of vernal pool wetlands on a 60-acre portion of the Wurlitzer Ranch. The preserve supports about seven acres of created vernal pools and vernal swale wetlands, and a population of Butte County Meadowfoam (*Limnanthes floccosa* ssp. *californica*) (BCM) established by hand-seeding about one mile of appropriate swale and pool edge habitat with BCM seeds collected from a site in southeast Chico. The BCM population varies in size from a few plants to over 200,000 plants, depending on the precipitation year and other factors still under study. We annually count all the plants on the preserve, as well as those in a reference (though ungrazed) native population (at Doe Mill Preserve, in southeast Chico) and have been able to observe population dynamics of what we consider to be the core population and several marginal outlier portions of the population for the last 15 years, through periods of fallowing, heavy-to-light grazing, burns, high-to-low precipitation years, and other variable factors. We find that the population of the annual species tracks fairly closely the dynamics of the reference population, and that there is

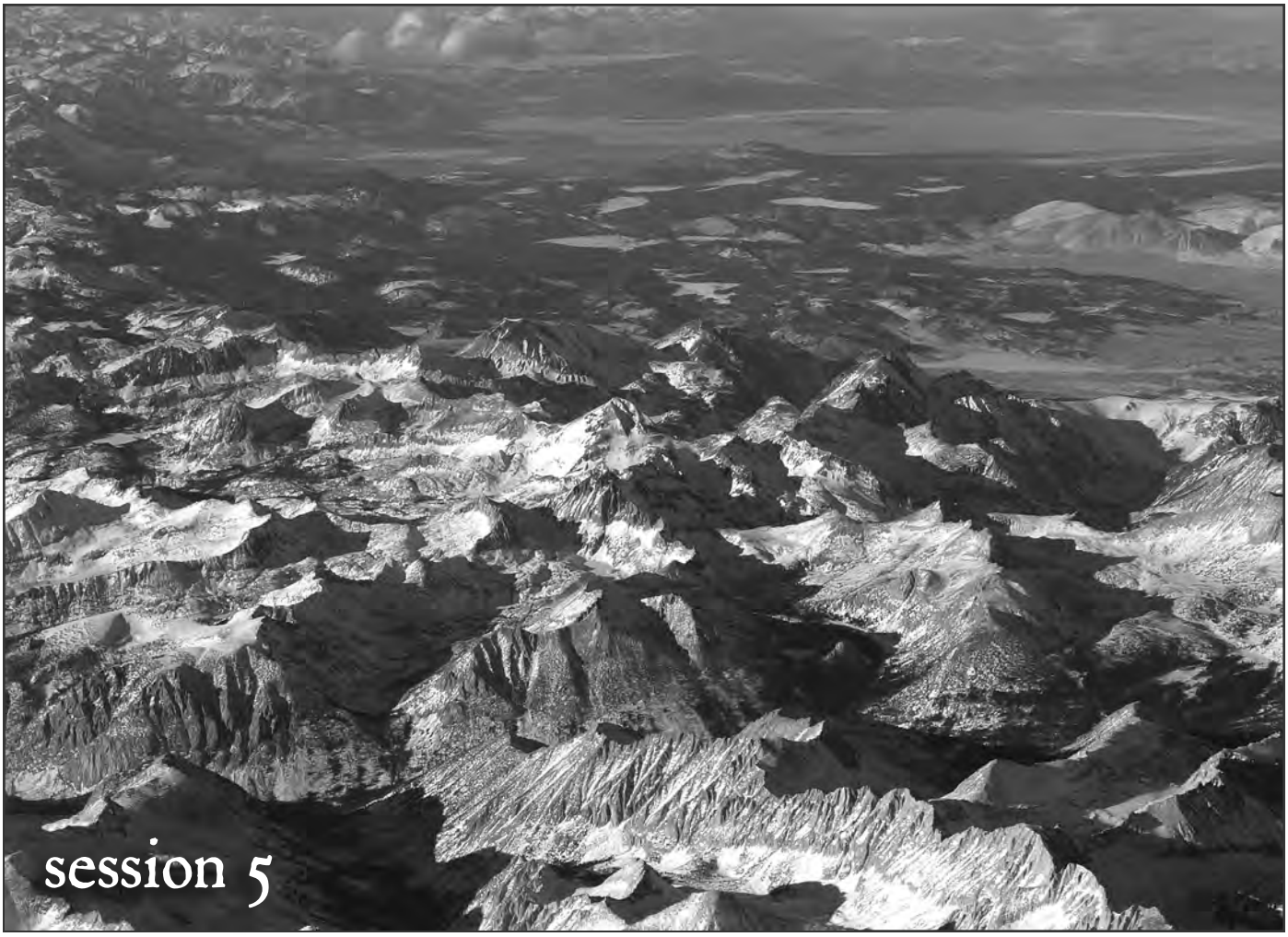
apparently a strong dependent relationship of the robustness of the core population to the outlier populations on the same landscape. We will provide a technical and botanical analysis of collection and monitoring efforts, plant stewardship, fecundity, and comparisons between years and sites. Techniques for establishing a population of an annual species will be discussed. We will present what we think are standards for determining when a translocated population of an annual plant species has been successfully established, and will offer this population as an example of such success.

Restoration and Livestock: Eastern Sierra Examples. *Robert Pearce*[*1], *Jessica Groves*[2], *Stella Moss*[3], *Casey Burns*[4], *Peter Frick*[5], *and Bob Hartnack*[6]. [1]*NRCS, 270 See Vee Lane, Suite 6, Bishop 93514.* [2]*NRCS, 430 G Street, Davis 95616.* [3] *PRBO Conservation Science, 3820 Cypress Dr. #11, Petaluma 94954.* [4]*NRCS, 3380 Somis Rd., Somis 93066.* [5]*Greenbridges, LLC, 5100 California Ave., Suite 234, Bakersfield 93309.* [6]*Adobe Valley, LLC, 5100 California Ave., Suite 234, Bakersfield 93309.*
robert.pearce@ca.usda.gov

Restoration goals and livestock management are often seen as being at odds with one another. In this presentation we describe instances where livestock and restoration go hand in hand focusing primarily on a Natural Resources Conservation Service (NRCS) Wetland Reserve Program (WRP) easement located on Adobe Creek, Mono County, California. The Adobe project began in 2003 and has gone through primary planning, engineering, and project implementation phases. Initial restoration work began in 2007. This presentation shows the restoration efforts and management to date, including the use of sheep and cattle grazing for vegetation management. The Adobe easement covers approximately 1,600 acres. The primary goals of the project are to enhance wildlife habitat, and to restore irrigated meadows and grazing lands to native wetland, riparian, and upland habitats. The project increases the habitat complexity and total acreage of wetlands for shorebird and waterfowl habitat, and restores streams to benefit Neotropical migrant and resident songbirds. Through adaptive management we will restore irrigated meadows to a combination of seasonal wetlands and upland shrub habitat. In order to measure the success of the project we have implemented a multifaceted monitoring component. Monitoring will allow us to track changes in stream geomorphology, discharge, wetland function and condition, vegetation species composition, and the response of bird populations and other wildlife. The Adobe WRP project is a perpetual easement and will require adaptive management in response to habitat changes as the project moves forward.

Responses of a Grassland Vernal Pool Ecosystem to Grazed and Fallow Conditions. *Steven N. Talley*[1], *Roderick L. Macdonald*[2] *and David B. Kelley*[*2]. [1]*4300 Eucalyptus Road, Fair Oaks 95628.* [2]*Tuscan, Inc., 20 E. Baker Street, Winters 95694.*

Since 1994 the 60-acre Tuscan Preserve on the Wurlitzer Ranch in northern Butte County, CA has been the site of studies to determine the effects of cattle grazing and climate upon an annual grassland-seasonal wetland-vernal pool ecosystem. From 1994 through spring 2000 the site was allowed to remain fallow (grazers were excluded) after seven decades of cattle grazing. Under fallow conditions there was widespread decline in native species richness and cover and a concurrent increase in cover of exotic species, especially *Lolium perenne* and *Taeniatherum caput-medusae* at both wetland and upland sites. However, the declines in native species were greatest in wetlands including saturated and shallow flooded edges of vernal pools, drainage swales, and clay flats. Grazers were gradually and lightly returned to the system in the winter of 2000–2001. Beginning in spring 2001 and continuing through 2005 there was widespread recovery of native species richness but not cover in both wetlands and uplands. There was little or no recovery in the upland well-drained grasslands. Within vernal pool basins recovery under moderate grazing was more complete. These data suggest higher grazing intensities are necessary for optimal expression of native species in the grasslands outside of vernal pool basins. Since 2007 grazing has been heavy. Data from 2008 and 2009 indicate a delayed return to the high 1995 cover of native species in uplands and shallow wetlands. Comparison of preserve samples to similar habitats adjacent to the preserve which have been heavily grazed throughout the study period indicate that periods of low precipitation are factors hindering recovery of late flowering native species.



Restoration, Realignment and Resource Management for Changing Climates

Chair: **Harry Oakes** *Habitat Restoration Planner, ICF International*

Regionally-adapted Ecotypes to Increase Native Seed availability for the Desert Southwest. *Mary Hershdorfer. USDA-NRCS Tucson Plant Materials Center, 3241 North Romero Rd., Tucson, AZ 85705.*
mary.hershdorfer@az.usda.gov

Restoration efforts in the desert southwest face a challenge when it comes to the availability of native seed. Few commercial growers exist in this region. The seed market is unpredictable. Many plantings are conducted using "common" seed, without consideration of genetic origin or locality, often resulting in low germination rate or persistence. The use of locally adapted ecotypes is desirable for greater planting success, however this seed is typically hand-harvested by contracted seed collectors at a high price. The Tucson Plant Materials Center (PMC) encourages the use of regionally adapted ecotypes to decrease price of seed and increase the success of plantings. Seed grown agronomically decreases the price per pound. Increasing genetic origin of the population to a larger geographic area increases the marketability of the seed. Seed populations with high genetic diversity have a greater ability to survive droughts, and adapt to changes in the climate. The Tucson PMC is currently developing several regionally-adapted species releases in crossing blocks, incorporating collections from as many different ecological zones as possible across the intended region of use.

Restoration Nursery Practices for Changing Climates. *Michele Laskowski. Propagule Collection Specialist, Presidio Native Plant Nursery, Golden Gate National Parks Conservancy, Building 201, Fort Mason, San Francisco 94123.*
mlaskowski@parksconservancy.org

Every year nurseries supply millions of plants for restoration projects around California. Restoration ecologists can take an active role in two primary ways: 1) to assure that plants produced are well-adapted and will thrive under a variety of future climate conditions; and 2) are produced in a way that has the least environmental impact. A check list of deliberate steps that can be taken throughout the entire propagule collection

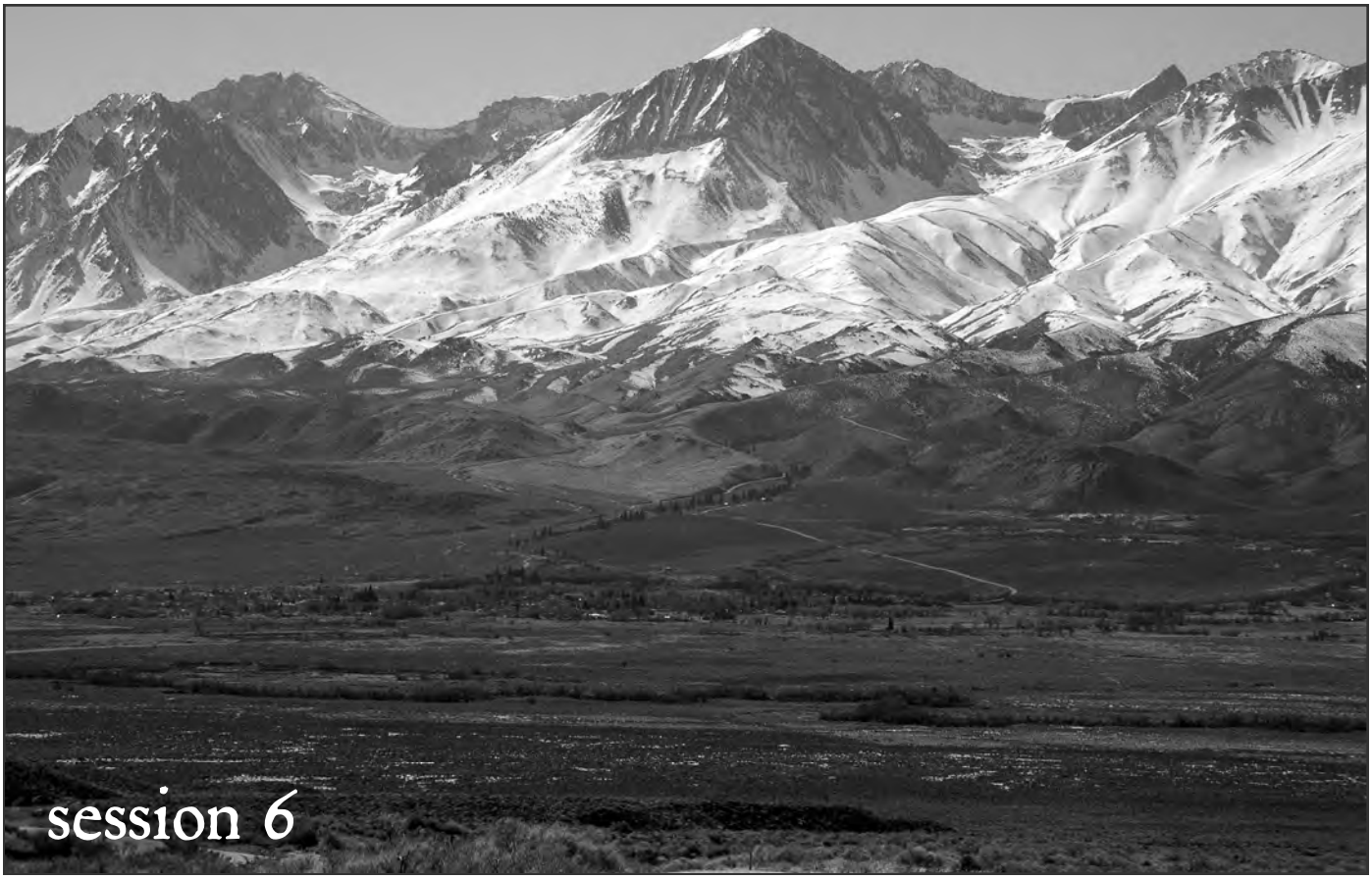
and growing process to minimize the production "footprint" will be provided. Ways to assure responsible use of the required natural resources and materials will be elaborated. A key step in achieving a self-sustaining restored habitat for the future is to produce plants that are well-adapted to the site and have the genetic diversity to adapt to a shifting climate regime. Local seed collection principles to help ensure a broad genetic base to prevent genetic degradation and allow for natural selection and gene flow will be discussed. Additionally, highlights of propagation protocols and growing techniques to reduce artificial selection will be covered. This discussion will be followed by examples of sustainable growing practices that have been developed through years of experience and scientific experimentation.

Revisiting Restoration Genetics in the Context of Climate Change. *Deborah L. Rogers. Center for Natural Lands Management, 215 West Ash Street, Fallbrook 92028; and Department of Plant Science, UC Davis.* **drogers@cnlm.org** and **debrogers@ucdavis.edu**

Restoration decisions should be guided by not only by management objectives and ecological considerations, but the genetic diversity within the species. Risks of inappropriately or insufficiently considering the genetic issues of plant restoration include contributing to genetic erosion, undermining local adaptations, creating opportunities for ill-fated hybridizations, and even reducing diversity in co-adapted species. The spatial scales and contexts for genetic restoration vary in wide measure from small restoration projects of locally restricted species, to large natural areas where assisted regeneration is considered desirable after an extreme event such as a flood or fire, or a long-term use such as grazing or wood harvesting. In California, genetic information has long been considered in revegetation decisions for commercially significant forest tree species (e.g., Douglas-fir, coast redwood, many pine species). Understory species—such as grasses, ferns, herbs, and shrubs—have had much less attention. Genetic considerations are just as important to restoration success with these species as with their commercial counterparts. In the context of climate change, such decisions are more important than ever, and also require revisiting classic restoration genetic principles. The presentation will provide the genetic principles and links to reference materials that can serve as a basis for sound genetic restoration decisions. I will emphasize appropriate use of genetic tools and interpretation of genetic information, how to work with suitable proxies in the absence of genetic information, and consideration of risks. The importance of recording genetic source of restoration materials and monitoring restoration success will be explained. The nexus with climate change—including effects on invasiveness and disruption of daylength-temperature linkages—will be discussed.

Framework for Responding to Climate Change — Inyo National Forest. *Jim Upchurch. Forest Supervisor, Inyo National Forest, 351 Pacu Lane, Bishop 93514.* **jupchurch01@fs.fed.us**

The Forest Service is looking at ways to adapt management direction and projects to respond to climate change effects. The Pacific Southwest Region of the Forest Service has developed a leadership intent to retain and reestablish ecological resilience to achieve sustainable management of the National Forests in response to environmental conditions such as climate change and increasing human use. This discussion will examine the Forest Service leadership intent for ecological restoration and look at specific projects that are occurring on the Inyo National Forest to implement this intent and respond to these changes.



Fisheries Restoration Efforts in California

Chair: **Ross Taylor** *Principal, Ross Taylor & Associates*

Two Decades of Fish Habitat Restoration in the City of Arcata on North Humboldt Bay, California. *Mark Andre. Director Environmental Services, City of Arcata, 736 F Street, Arcata 95521.* **mandre@cityofarcata.org**.

The City of Arcata is situated on Humboldt Bay, one of the most important estuaries on California's coast. To implement a host of City environmental policies, goals and adopted plans, a large number of habitat restoration projects have been conducted in the City's five watersheds since 1984.

In this paper the author focuses on lessons learned from aspects of some of the older projects as well as the progress of more recent projects conducted in the lower estuaries of anadromous watersheds.

Restoration actions have included "daylighting" creek segments in down town areas, large scale estuarine and salt marsh projects, installing fish friendly tide gates to restore fish passage, reestablishing floodplains connected to altered watercourses, setting back or breaching levees and establishing riparian cover.

The goal of Arcata's restoration program is to modify disturbed ecosystems so that they more closely resemble a desired condition. The desired condition is usually is one that is matched to a reference condition or by retrospective work looking at old historic maps and photos. Key to the success of the habitat restoration effort in Arcata is having a wealth of local science and expertise to draw upon as well as involvement of the citizenry in restoration efforts. Participation in restoration projects helps bring the community together and create a social identity, sense of place and local pride in their community. The social dimensions of restoration close to population centers also provides opportunity for education and for building a constituency that will support restoration efforts in the future.

Fisheries Restoration in the Five Counties Salmonid Conservation Program. *Christine Jordan. Five Counties Salmonid Conservation Program. P.O. Box 2571, Weaverville 96093.* **cjordan@5counties.org**

The Five Counties Salmonid Conservation Program (5C) is a watershed and salmonid conservation effort formed in 1997 by Del Norte, Humboldt, Mendocino, Siskiyou and Trinity Counties in response to the Threatened listing of coho salmon. The 5C goal is to protect the economic and social resources of Northwestern California by providing for the conservation and restoration of salmonid populations to healthy and sustainable levels, basing decisions on watershed rather than County boundaries. Key program elements include fish passage, sediment reduction, and land use planning. For decades, culverts and other structures on roads have disrupted the spawning and rearing behavior of anadromous salmonids in California.

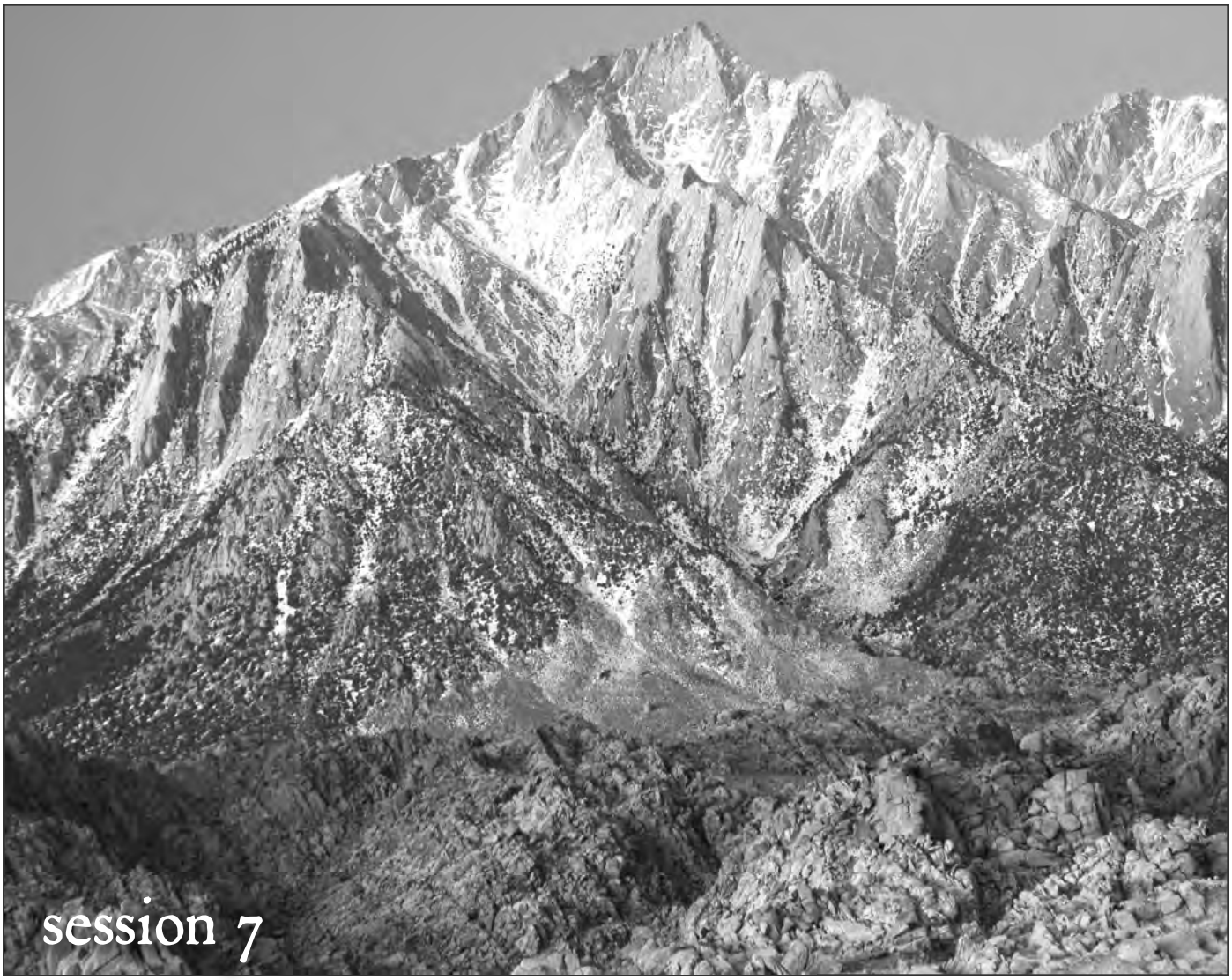
From 1998-2004, an inventory of 245 county maintained crossings was completed and barriers were prioritized based on biological and physical parameters which provided a first-cut evaluation of high priority sites to program for design and construction. The implementation stage of the fish passage element has been well underway since 1999 and 2009 marked the completion of 56 projects that restored access to 137 miles. In addition to fish passage, the sediment reduction program, County personnel training, and the 5C Roads Manual completion are all milestones for the Program's effectiveness. 2,455 miles of county roadway have been inventoried for sediment sources and 15 projects have been completed. The Roads Manual, a guide and framework for implementing improved maintenance practices, was written and has received ESA approval under the NMFS 4(d) rule. The Program provides an improved understanding and support for similar conservation and restoration efforts in California.

Restoring a Rare Native Fish, the Hitch *Lavinia exilicauda chi*: Biology, Ecology, and an Initial Adaptive Management Plan. *Erik Ringelberg*[*1] and Dietrick McGinnis*[*2]. [1]BSK Associates, 3140 Gold Camp Dr., Suite 160, Rancho Cordova 95670. [2]McGinnis and Associates, 2655 Rose Mist, Reno NV 89521.* **eringelberg@bskinc.com** and **dmcginnis@sbcglobal.net**.

The hitch, *Lavinia exilicauda chi,* is a California Species of Special Concern and a species of tribal concern to Clear Lake Pomo. The large cyprinid has only been documented spawning in two of the tributaries of Clear Lake, located in the Coastal Range of California. The future survival of this fish is at risk due to its limited range, narrow spawning window, and declining stream water levels during the breeding period. The Clear Lake splittail (*Pogonichthys ciscoides*) has gone extinct, presumably due to lack of suitable spawning habitat and competition from introduced species. In early 2009, a coalition of Clear Lake tribes, The Elem Indian Colony, Robinson Rancheria, Big Valley Rancheria and Habematolel Pomo of Upper Lake, with funding support from the US Fish and Wildlife Service, began a trapping and tagging program to assess elements of the basic biology of the hitch, numbers of remaining fish, stream use and fidelity; and identify habitat, water quality and creek stage level correlates. A total of 208 hitch were tagged with uniquely coded, standard frequency, Radio Frequency ID tags. Initial results indicate several areas for further study: Virtually all fish captured had significant number of external parasites; stream stage declines were rapid and lead to stranding of millions of eggs; of the unoccupied tributaries, only three appear to meet water quality and quantity requirements, but these streams also have fish passage considerations. Finally, an initial, collaborative Adaptive Management Plan has been developed by the Tribes in response to the historic hitch data and the recent findings.

Restoration of a Self-sustaining Trout Population in Lower Rush Creek. *Ross N. Taylor. Ross Taylor and Associates, 1254 Quail Run Court, McKinleyville 95519.* **rossntaylor@sbcglobal.net**

Prior to the export of water from Mono Basin streams by Los Angeles Department of Water and Power (LADWP) in 1941, lower Rush Creek contained a self-sustaining population of brown trout (*Salmo trutta*) that supported a popular fishery. LADWP's exports virtually de-watered Rush Creek in most years during the 1950s, 60s and 70s. In 1994, the State Water Resources Control Board's Decision-1631 amended LADWP's water rights to establish instream fishery and channel maintenance flows. Decision-1631 also required LADWP to prepare a Stream Restoration Plan. Monitoring of the Restoration Plan was established by SWRCB Order 98-05 which also revised the D-1631 flows and established minimum baseflows and "Stream Restoration Flows" (SRFs). Initial restoration efforts focused on physically manipulating Rush Creek's channel. These early efforts had mixed results and the SRF flows were developed to mimic snowmelt runoff that would perform the geomorphic work of channel restoration, especially in wetter years. This "hands-off" approach triggered the recovery of Rush Creek's riparian vegetation, which in turn solidified stream banks. Habitat typing studies conducted in 1991, 2002 and 2008 quantified the evolution of pool development in Rush Creek, primarily a result of large SRF releases in 2005 and 2006. The instream flows recommended in 1994 are currently being re-evaluated by SWRCB-appointed scientists after 12 years of fisheries, geomorphic and riparian vegetation monitoring. Recommended modifications to Rush Creek's hydrograph to improve the growth and survival of brown trout include lowering winter baseflows to increase holding habitat and managing for a fuller Grant Lake Reservoir to provide cooler water releases during summer months.



Research, Restoration and Revegetation on LADWP Lands in the Eastern Sierra Nevada

Chair: **Dave Martin** *Watershed Resource Specialist, Los Angeles Department of Water & Power*

Lower Owens River Project- Restoration of a River Once Dry. *Lori Dermody. Watershed Resources Specialist, City of Los Angeles Department of Water and Power, 300 Mandich Street, Bishop 93514.* **lori.dermody@ladwp.com**

The Lower Owens River Project (LORP) is the largest river restoration project in the western United States, and is being jointly implemented by the City of Los Angeles Department of Water and Power (LADWP) and Inyo County. The LORP includes four primary restoration elements: (1) releasing water to the Lower Owens River to enhance native and game fisheries and riparian habitats along 62 miles of near-dry river channel; (2) providing water to the Owens River Delta to maintain and enhance various wetland and aquatic habitats; (3) enhancing the 1,500-acre off-river Blackrock area with seasonal flooding and land management to benefit wetlands and waterfowl; and (4) maintaining several off-river lakes and ponds for fishery and wildlife benefits. In addition, the project includes range management improvements, modified grazing programs, and recreation management strategies to provide additional benefits. To date, LADWP has completed all related project construction and rewatered the Lower Owens River in December 2006. LADWP maintains a base flow of 40 cfs in the river at all times and implements an annual seasonal habitat flow to maximize recruitment of desirable riparian species. Approximately 40 miles of new fencing has been installed for grazing and recreation management, and LADWP and Inyo County are in the process of carrying out all of the monitoring requirements that are described in the LORP Monitoring and Adaptive Management Plan (MAMP). Monitoring results will guide future management of the LORP and will be geared accordingly to achieve project goals.

Biomass Production and Water Requirements of Common Owens Valley Plants. *Tracie Evans[1]*, Ricardo Mata-Gonzalez[1], David Martin[2], and Terry McLendon[3]. [1]Oregon State University, Department of Rangeland Ecology and Management, 202 Strand Agriculture Hall, OSU, Corvallis OR 97331. [2]Los Angeles Department of Water and Power, 300 Mandich St., Bishop 93514. [3]Ecological Consultant, 1101 Buttonwood, Fort Collins CO 80523.* **evanstr@onid.orst.edu**

Despite recent studies conducted on Owens Valley there is no information on water requirements of typical plant species of the area. This study addressed the issue of how much water is required for above-ground biomass production of important plant species. Plants were grown in the field as a garden study in 2.4 m x 2.4 m plots and irrigated at different monthly rates: low (12 mm), middle (25 mm), and high (37 mm) during the summer of 2009. In general, higher irrigation rates produced higher biomass, but for the three grasses investigated (*Distichlis spicata*, *Leymus triticoides and Sporobolus airoides)* the low and middle irrigation levels did not produce significant differences in biomass production. *S. airoides* was the most efficient grass; it required about 3.5 liters of water to produce one gram of biomass. Water requirements of *D. spicata* and *L. triticoides* were 2.6 and 9.5 times larger than those of *S. airoides.* Water requirements were in general lower in shrubs than in grasses; *Artemisia tridentata* was the most efficient shrub with 1.2 liters of water used per gram of biomass produced. Water requirements in this study included evaporation and transpiration losses and adjustments for ground cover need to be considered. This is an ongoing study and in a subsequent field season we will analyze above- and below-ground biomass production. Results can be used to better estimate water usage of the different types of vegetation in Owens Valley.

LADWP Revegetation Efforts on Abandoned Agricultural Land. *Lori Gillem. Watershed Resources Specialist, Los Angeles Department of Water and Power, 300 Mandich Street, Bishop 93514.* **lori.gillem@ladwp.com**

Revegetation on abandoned agriculture lands in the Owens Valley is an on going effort for the Los Angeles Department of Water and Power (LADWP). Parcels of land from Laws to Lone Pine have been classified as abandoned agriculture, and are in the process of being returned to a more natural state. Methods of revegetation utilized are varied and include: exclusion of disturbances, dry land experimental methods, planting and irrigation treatments, seeding with sprinkler irrigation, growing seedlings from local seed and planting seedlings with drip irrigation. LADWP is monitoring parcels throughout the valley that are being managed for native plant revegetation. Excluding disturbances on some parcels has been a successful revegetation method. Dry land experimental methods had low success overall and demonstrated that irrigation often is necessary for the establishment of plants in an arid climate. Irrigation and seedling planting has been successful with the use of a drip irrigation system, however sprinkler irrigation did not yield the same results. Seeding with sprinkler and drip irrigation systems has varied results. Seedling planting with drip irrigation has been successful and continues to be our favored method given short time constraints that we often have to deal with. However, LADWP is continuing to study other methods and techniques for revegetation.

Ecosystem Effects of Groundwater Depth in Owens Valley, California. *Christine M. Goedhart[1]* and D.E. Pataki[1,2]. [1]Department of Ecology & Evolutionary Biology, UC Irvine, Irvine 92697. [2]Department of Earth System Science, UC Irvine 92697.* **cgoedhar@uci.edu**

Owens Valley is an important source of water for the city of Los Angeles; however, recent studies have documented losses of grass cover coinciding with decreased watertable depths in many locations. These changes in community composition are assumed to be associated with shallower rooting depths and greater vulnerability to declining watertable depths in grasses compared to neighboring shrubs. However, the hydraulic properties and water stress resistance of most species in Owens Valley have not been measured. In addition, the linkages between groundwater depth and other aspects of ecosystem function such as nutrient cycling are not well understood. In this study we measured grass and shrub cover, vulnerability to cavitation, and plant and soil isotopic and chemical composition at 9 sites along a depth to watertable gradient of 0.3-5.7 m in Owens Valley. Contrary to expectations, the grass species was more resistant to water stress induced cavitation than either shrub species. However, grass cover declined in sites with deeper watertables while shrub cover remained constant. Water isotopes indicated shallower rooting depths in grasses than in shrubs, although the phreatophytic shrub *Ericameria nauseosa* had enriched leaf water isotopes at deep groundwater sites, indicating water stress. Sites with lower grass cover contained less soil nitrogen (N) that was also more isotopically depleted, which is indicative of greater ecosystem N losses. These results show that groundwater depth is correlated with a number of ecosystem traits in these Great Basin Desert ecosystems, and should be considered when evaluating future changes in groundwater depth.

Vegetation Response Following Changes in Livestock Use on the Lower Owens River. *John Hays* and Gary Peek. Watershed Resources Specialist, Department of Water & Power, City of Los Angeles, 300 Mandich St., Bishop 93514.* **john.hays@ladwp.com** and **gary.peek@ladwp.com**

In tandem with the restoration efforts of returning flows to the Lower Owens River, the Los Angeles Department of Water and Power (LADWP) constructed riparian pastures along the 61 mile reach of the Lower Owens River. Utilization standards

continued

were established for the riparian and adjacent upland pastures and an extensive rangeland vegetation monitoring program focusing on long term trend began in 2002. There are two primary goals to the monitoring project: 1) Evaluate the impacts from the re-watering of a historically dry river and the changes livestock use has had along axial stream floodplains and adjacent uplands, 2) Use these data to make informed decisions using an adaptive management approach. We will present an overview of the range monitoring goals and methods used for estimating vegetative attributes and livestock use. We will present a summary of results compiled from five sampling periods beginning prior to return flows in 2002 to the summer of 2009. We will also discuss what changes in current management have occurred as a result of the monitoring program and discuss some of the lessons learned along the way.

Assessment of Waterbird Response to Early Post-implementation Delta Habitat Area Changes. *Debbie House. Los Angeles Department of Water and Power, Bishop 93514.* **debbie.house@ladwp.com**

The Delta Habitat Area component of the Lower Owens River restoration project lies at the terminus of the river in southern Owens Valley. Management goals are to maintain and enhance existing wetlands for waterfowl and shorebirds through regulated base flows and timed pulse flows. Early habitat responses from water management changes include increases in habitat diversity through expansion of mesic wetland types, and periodic flooding of lacustrine habitats. Overall bird use of DHA has increased since project implementation. Habitat indicator species (HIS) have been most often associated with fresh emergent wetland, wet meadow, riverine and lacustrine habitats. The suite of HIS selected have responded differently to habitat changes. A positive response has been seen primarily from HIS associated with marsh and wet meadow habitats. California Wildlife Habitat Relationships (CHWR) system is being used in conjunction with bird monitoring and vegetation mapping to evaluate the availability of habitats for HIS. Challenges associated with use of CWHR in this area, as well as with the use of HIS will be touched on briefly in order to encourage feedback and discussion.

Soil Microbial Inoculation to Assist in Revegetation of Degraded Areas. *Ricardo Mata-Gonzalez[1]*, Terry McLendon[2], David Martin[3], and David Price[4]. [1]Oregon State University, Department of Rangeland Ecology and Management, 205B Strand Agriculture Hall, OSU, Corvallis OR 97331. [2]Ecological Consultant, 1101 Buttonwood, Fort Collins CO 80523. [3]Los Angeles Department of Water and Power, 300 Mandich St., Bishop 93514. [4]U.S. Army Engineer Research and Development Center, Vicksburg MS 39180.* **ricardo.matagonzalez@oregonstate.edu**

Degraded plant ecosystems are often accompanied by a loss of biological soil properties such as microbial activity. In turn, soil microbial degradation limits the potential for reestablishment of native vegetation. In this study we inoculated field revegetation plots with native soil microbial communities to evaluate its potential effect in plant reestablishment. The revegetation site was located on the north portion of the Owens Valley. The experimental unit was a 1 m^2 plot where we tested the presence of absence of 1) inoculation, 2) seeding, and 3) watering. The seed mix consisted of native plant species (*Atriplex canescens, Artemisia tridentata, Atriplex confertifolia, Sarcobatus vermiculatus, Leymus triticoides, and Oryzopsis hymenoides*) at a rate of 4.5 g per plot PLS. We evaluated plant cover and density for two years (2008 and 2009). Plant establishment was severely limited by external factors such as wind and herbivores. The species that better established was *A. canescens* with a maximum plant cover of 5% in plots that were seeded, watered, and inoculated. In general, inoculation had a positive effect on plant establishment, resulting in twice as much plant cover as no inoculation in seeded plots. Plant cover was similar in 2008 and 2009, but plant density declined in 2009 (max 1.6 plants/m^2) with respect to 2008 (max 5 plants/m^2). Although we obtained a modest success in our revegetation effort, our results suggest that soil microbial inoculation is a viable tool to favor restoration of degraded areas in Owens Valley.

Wetland Habitat Creation on Owens Lake Playa. *Jeff Nordin. City of Los Angeles, Department of Water and Power, 300 Mandich Street, Bishop 93514.* **Jeffrey.Nordin@ladwp.com**

Dust mitigation has been implemented on Owens Lake by flooding emissive areas of playa starting in 2002. This area represents over 16,000 acres of playa consisting of islands interspersed with shallow braided channels terminating in ponds of various depths. Most areas are saline, resulting from the mass of salt in the groundwater and soil. Some areas of playa adjacent to the historic shoreline have relatively low salinity but still above thresholds for germination of most species. With leaching of soil with freshwater the rhizosphere became suitable for seed germination in these areas. Approximately 40 acres of playa were drill seeded in 2006 with fourteen different species, along with plugs of *Juncus mexicanus*; the goal being to create Moist and Saturated Transmontane Alkali Meadow (MAM and SAM). This created wetland habitat has increased in cover from almost barren, except for a couple small isolated spring mounds, to an average of 42% ±3.8 (SE) cover of hydrophytes in three growing seasons. Species richness has exceeded native MAM and SAM, with 4.1 ±0.44 (SE) species per plot and 24 species in the combined sample. Dominant species observed in the wetland area include *Distichlis spicata, J. mexicanus, Schoenoplectus americanus, S. maritimus* and *Typha* sp. With the continued application of freshwater, the extent of vegetation has expanded through seed dispersal to over 500 acres in the immediate area. This wetland vegetation has resulted in dramatically increased use by waterfowl (mostly dabbling ducks) and shorebirds especially during spring and fall migration.

WEEDS: Burn em? Cultivate em or Eat em?

Chair: **Ralph D. Vigil** *Director of Habitat Management, Restoration Resources*

Grazing and Weed Management Planning and Implementation. *Chad Aakre. Restoration Resources, 3868 Cincinnati Avenue, Rocklin 95765.* **c.aakre@restoration-resources.net**

A *Grazing and Yellow Star-thistle Management Plan* (Plan) was created for the Butte SR 70/149/99/191 Vernal Pool Mitigation Project (Project) which was designed to partially mitigate for impacts arising from the highway improvement project. The site is currently being monitored and managed by Restoration Resources. The 441-acre Project site is located 13.5 miles southeast of Chico in Butte County, California. The goals of the Plan are to maximize native plant cover and diversity; to minimize non-native, invasive plant cover; to use well-planned livestock grazing as the primary management technique; and to maximize cost/benefits ratio for stakeholders. In order to achieve the aforementioned goals, the grazer must provide the land manager with detailed information of on-the-ground practices and the land manager must provide the grazer with recommendations that achieve management goals while steadily increasing profits to the grazer. Data will be collected during the 2009-2010 wet season, and all sub-sequent years, on appropriate vegetative metrics so that a large data-set can be assembled from which to base management recommendations. Residual dry matter will be measured by clipping and weighing standing dry matter in plots. Target non-native invasive species will be weighed separately to provide species specific residual dry matter levels. Monitoring will also take place at upland data points to provide information on grass height and vegetative structure on a monthly basis during the grazing season. Annual monitoring required by regulatory agencies during mitigation habitat establishment will continue to provide additional data that can be used to refine grazing recommendations.

An Integrated Approach to Controlling Non-Native Plant Species. *Ian Boyd. Restoration Resources, 3888 Cincinnati Ave., Rocklin 95765.* **i.boyd@restoration-resources.net**

The Arden Parallel Force Main Restoration Project - Oak Woodland/Grassland Mitigation Site at Discovery Park, Sacramento, CA was planted with 409 native woody plants in December 2008 and 99,000 native herbaceous plugs in February 2009. Prior to the installation of native herbaceous plugs, the site was treated with a solution of aminopyralid (Milestone) and glyphosate (Round-Up) to reduce existing and emerging herbaceous vegetation that would inhibit the establishment of native herbaceous plugs. A qualitative monitoring event occurred in Year 1 (2009) and revealed that approximately 2 percent of the herbaceous vegetative cover was native and that a high volume of non-native plants had propagated throughout

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the site. Although Johnson grass (*Sorghum halepense*) and Bermuda grass (*Cynodon dactylon*) are not considered highly invasive species in the project performance criteria, it was determined that these particular species posed the most significant threat to the installed native herbaceous plugs. An integrated approach between chemical and mechanical weed control techniques was applied to control the growth of these two target species in conjunction with reduced overhead irrigation regimes. The weed control methodologies that were implemented in Year 1 were designed to stress the target non-native plants that persisted beyond the initial chemical application, while having as little an impact on the installed native herbaceous plugs. Year 2 (2010) monitoring results will determine the efficacy of such methods and allow the management team to prescribe new or similar adaptive management measures as needed.

Cocktails, Anyone? Using Herbicide Tank Mixes to Optimize Weed Control. *Scott A. Johnson. Pest Control Advisor and Vegetation Management Specialist, Wilbur-Ellis Company, Agribusiness Division, 1710 Fluetsch Court, Stockton 95207.* **sjohnson@wilburellis.com**

Vegetation managers are often faced with the challenge of managing multiple weed and brush species on the same site. It is rare that one herbicide will control all weed species. This presentation will discuss how mixing herbicides and adjuvants can broaden the control spectrum of a treatment. These mixes usually have different modes of action, which can also as help with resistance management.

California Department of Pesticide Regulation (CDPR)Enforcement Response Regulations. *Scott A. Johnson. Pest Control Advisor and Vegetation Management Specialist, Wilbur-Ellis Company, Agribusiness Division, 1710 Fluetsch Court, Stockton 95207.* **sjohnson@wilburellis.com**

The California Department of Pesticide Regulation (CDPR) formalized their Enforcement Response Regulations in late 2006. Title 3, California Code of Regulations sections 6128 and 6130 specify the appropriate and required enforcement responses/actions (section 6128) that county agricultural commissioners must take for specific classes of violations (section 6130) in specific situations. The regulations strengthen environmental enforcement and improve statewide consistency of enforcement responses used by the counties. This presentation will focus on four main topics: enforcement response, compliance action, enforcement action, and decision report. Details of sections 6128 may be found online at **www.cdpr.ca.gov/docs/legbills/calcode/010301.htm#a6128** and details of sections 6130 may be found online at **www.cdpr.ca.gov/docs/legbills/calcode/010301.htm#a6130**.

Yellow Starthistle Control Using Fire, Herbicides, and Native Perennial Grasses. *James S. Jones. East Bay Municipal Utility District, Fisheries and Wildlife Division, #1 Winemasters Way, Suite K2, Lodi 95240.* **jjones@ebmud.com**

The removal of weed species by itself is not sufficient to restore native grasslands. The spaces left in the ecological system will be filled, either by undesirable or desirable species. The desirable species composition can be influenced by planting self sustaining native grasses. In 2001 East Bay Municipal Utility District (EBMUD) began a test project on 15 acres of annual grassland/blue oak woodland to reduce and control yellow starthistle (*Centaurea solstitialis*). Prior to planting, the site was prepared with controlled burns and herbicide application in the summer and fall 2001. A land imprinter was used to seed the site in the winter of 2002. A mixture of purple needlegrass (*Nassella pulchra*), nodding needlegrass (*Nassella cernua*), California oniongrass (*Melica california*), big squirreltail (*Elymus multisetus*), blue wildrye (*Elymus glaucus*), California brome (*Bromus carinatus*), Idaho fescue (*Festuca idahoensis*), and pine bluegrass (*Poa secunda secunda*) were seeded at a density of 200 seeds/sq ft. Mycorrhizal fungi was applied, at a rate of 40 lbs/acre, with the seeds. The site was again treated with herbicides for weed suppression in spring 2002, 2003, and 2009. The vegetative community has been monitored since the planting using percent species composition. Native grasses have become well established and yellow starthistle has been significantly reduced.

Multi-Objective Riparian Revegetation with *Conium maculatum* Control. *Carol Presley* and Leo Dumont. Santa Clara Valley Water District, 5750 Almaden Expressway, San Jose 95118.* **cpresley@valleywater.org**

Conium maculatum, or poison hemlock, has become an invasive pest in disturbed landscapes including riparian corridors. Although the objective of this revegetation project was not to execute invasive plant control, it became a necessary and unavoidable consideration given its abundance on site. The primary objective of the project was to enhance Tick Creek, a mostly denuded creek in southern Santa Clara County, with riparian vegetation and plants that function as beneficial insectaries. The creek runs betwixt acreage in organic row crop cultivation to the west and to the east by fields in conventional cultivation, both of which benefit from services provided by large populations of beneficial insects. Propagules of a variety of site specific species were collected and contract grown including coyote brush (*Baccharis pilularis*), elderberry (*Sambucus mexicana*), California aster (*Aster chilensis*), western goldenrod (*Euthamia occidentalis*) and mugwort (*Artemisia douglasiana*). These common components of riparian landscape offer beneficial insectary function. In addition, other California native plants highly regarded for their ability to attract beneficial insects were selected to provide successional blooming periods. The planting design incorporated a dense hedgerow planting of large shrubs and cluster planting of perennials to assist in weed suppression. Controlling weeds directly adjacent to organic cultivation required a review of non-herbicidal methods in compliance with organic growing certification. Given that reproduction of poison hemlock is solely through copious seed production,

corrugated cardboard and thick mulch application were employed as a pre-planting treatment to exclude sunlight and thus reduce germination rates of the resident seed bank.

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Adaptive Management for Perennial Pepperweed: An Ecosystem Approach.
Sara Sweet[*1], *Rachel A. Hutchinson*[2], *and Joshua H. Viers*[2]. [1]*The Nature Conservancy, 13501 Franklin Blvd., Galt 95632.* [2] *Department of Environmental Science and Policy, UC Davis, One Shields Ave., Davis 95616.* **ssweet@tnc.org**

The concept of adaptive management allows for ongoing modifications to a management strategy as knowledge is gained. Here, we present a case study of perennial pepperweed (*Lepidium latifolium*) management at the Cosumnes River Preserve. We will show how the implementation of a multi-year applied research program informed the evolution of a weed management strategy previously hindered by a lack of information about 1) the efficacy of different control techniques, 2) non-target vegetation effects, 3) the need for post-treatment restoration, and 4) the environmental uncertainty surrounding these results. The results of this experiment illustrate the highly variable and unpredictable environmental factors that can be integrated into the adaptive management model to better reflect the complexity of ecosystems, thereby better distinguishing between treatment and environmental effects. By integrating these complexities and uncertainties, we can inform decisions on where to allocate limited resources. For example, mapping pepperweed patches over four consecutive years showed that many patches inundated by the April 2006 flood produced few aboveground stems in the summer. Although patch rebound in 2007 shows flooding was not lethal, in 2006 there was too little aboveground biomass to absorb enough herbicide to kill the rhizomes. This result guides us to focus our limited resources on more upland populations in years with late spring floods. In the coming years, the preserve will implement the new management strategy for pepperweed control, and the challenge will be to retain adaptability despite fewer resources for quantitative monitoring and analysis.

Grazing: An Effective Tool in Coastal Sage Scrub Habitat Restoration.
Lily N. Verdone. Palos Verdes Peninsula Land Conservancy, 916 Silver Spur Road, Rolling Hills Estates 90274. **lverdone@pvplc.org**

The Palos Verdes Peninsula Land Conservancy used goats to graze a 21-acre coastal sage scrub and perennial grassland habitat restoration site as a method of weed control prior to planting. The purpose of this habitat restoration project is to establish ecologically appropriate native habitats in disturbed areas to enhance the ecological functions of the adjacent native habitats within the 98-acre Three Sisters Reserve, Los Angeles County, CA. Site preparation, consisting of weed control, is a necessary first step in this process to reduce the impacts of non-native plants and increase the establishment likelihood of native plants and seed. Limited site access, heavy accumulation of non-native plant thatch, and non-native acacia trees numbering in the hundreds made hand or mechanical site preparation difficult and costly. Alternatively, over a 19-day period, 250 goats were brought onto the site to graze non-native annual grasses, exotic mustard and fennel, browse on the lower branches of non-native acacia trees, and removed old plant thatch. The grazing was timed to coincide with the dormancy period of many native species, minimizing impact. Moveable electric fences were used to focus the grazing in areas dominated by non-native species and to control impacts of over-grazing. The site has since been planted with 8,000 container plants and 775 lbs. of native seed and is being evaluated for native and exotic species cover through performance monitoring.

Environmental Advocacy:
Developing Policy and Educational Outreach

Chair: **Lisa Cutting** *Eastern Sierra Policy Director, Mono Lake Committee*

The Sustainable Sites Initiative: Quantitative Performance Evaluation of Designed Landscapes. *Allegra Bukojemsky. ASLA Sustainable Design and Development PPN, Biohabitats, Inc., 520 Sutter St., San Francisco 94102.* **allegrab@biohabitats.com**

Green building standards, such as the U.S. Green Building Council's LEED® rating system, are driving environmentally superior building design and construction through voluntary market-based incentives. Measurable benefits - environmental, economic, and quality of life - result when people have the necessary information and tools to guide their design decisions and when commitment to excellence is recognized. By extending this approach beyond buildings to the planned landscape, we can realize even greater gains. Developed through the partnership of the American Society of Landscape Architects (ASLA), the Lady Bird Johnson Wildflower Center, and the US Botanic Garden, the Sustainable Sites Initiative (SITES™) is a first attempt to systematically apply the wealth of ecological knowledge to the design and management of anthropogenic systems. Credits ranging from stormwater management and hydrodynamics, soil health, air and water pollution reduction and abatement, and human wellbeing are designed to be applicable to a range of landscape based projects such as large campuses, public parks, conservation areas, recreation areas, and transportation and utility corridors. This presentation will provide an overview of the certification system with more detailed discussion of ecosystem preservation and restoration based credits.

Increasing Accountability and Achieving Results with Applied Adaptive Management. *Kevin Drake. Integrated Environmental Restoration Services, Inc., Tahoe City 96145.* **kdrake@IERStahoe.com**

A disparity often exists between proposed *plans* and implemented *projects.* Nevertheless, environmental advocacy groups must base decisions to support or oppose a proposed project based on plans with little to no assurance that the project will actually achieve the intended results on the ground. This presentation will describe a specific model of adaptive management and how it has been (and continues to be) applied on three contentious projects to build trust and achieve positive results through increased accountability. These success stories and ongoing projects — including ski area

expansion and forest fuels reduction in environmentally sensitive areas – will be used to illustrate the value of applied adaptive management as a systematic framework for translating positions and opinions into testable hypotheses, developing effective implementation and monitoring plans, and establishing feedback loops for tracking progress toward goals. This presentation will offer advocacy groups a proactive alternative to conventional legal pathways that is demonstrated to be effective at achieving desired results by establishing a common language and a framework for increasing accountability in project implementers.

Public Land Restoration and Stewardship Through Partnerships. *Jon Kazmierski. District Recreation Officer, Inyo National Forest, PO Box 429, Lee Vining 93546.* **jkazmierski@fs.fed.us**

Public land management agencies are large bureaucracies with policies and rules that often limit their ability to react to dynamic changes and pressures. Public lands belong to the American citizenry and few people participate in the stewardship of these unique resources. These two problems create an opportunity that has been capitalized on by the Inyo National Forest and several area non-profit organizations... partnerships for public land stewardship. Partner organizations have the ability to quickly recruit and develop expertise, skills, and knowledge that is critical in responding to changing recreation and resource demands. These organizations have devoted supporters and robust outreach abilities. Agencies provide the technical knowledge, planning tools, and authority. Working together strategically, projects compete better for grant support, citizens engage in stewardship, and meaningful projects are completed. The success of these partnerships relies upon the individuals involved and the nurturing of relationships, but also hinges on the ability of the agency and partners to navigate through agreement processes, cover liabilities, and clearly define expectations. Working together does make a difference and the Inyo National Forest has many suggestions for agencies and organizations who are considering partnership projects.

Filling a Gap – Building Ownership and Improving Land Health through Volunteer Public Lands Stewardship. *Paul McFarland. Executive Director, Friends of the Inyo, 699 West Line Street, Suite A, Bishop 93514.* **paulmc@friendsotheinyo.org**

America's public lands and waterways face a growing perfect storm. The combination of demographic shifts, changing recreational use patters and decreasing capacity in federal land management agencies has lead to increasing political polarization, escalating damage to land and water resources and growing public disenchantment with public lands management. Working in partnership with numerous public lands managers, NGOs, local governments and private citizens, Friends of the Inyo works to bridge the gap between the sound intentions codified in management plans, regulations and legislation and the on the ground condition of our public lands. By deliberately shifting land use discussions away from the philosophical world of the written word and onto the tangible world of sagebrush, picnic tables and clean Great Basin streams, Friends of the Inyo seeks to improve land health in real terms by getting people's hands dirty.

Sprouting an Urban, Grassroots Constituency through Restoration. *Bartshé Miller. Mono Lake Committee, PO Box 29, Lee Vining 93541.* **bartshe@monolake.org**

Low-tech restoration work on Mono Lake's tributary streams provides a powerful and enduring outdoor experience for urban youth from Los Angeles. Each year Mono Lake Committee (MLC) connects students from the city to the source of their water in the Mono Basin. MLC partners with Los Angeles Department of Water & Power and school and community groups in Los Angeles to provide education, recreation, and stewardship activities in the Mono Basin. The program is called Outdoor Experiences (OE). Engaging students in restoration work on Rush and Lee Vining Creeks is an important element of the OE program. A State Water Board-ordered adaptive management process for these creeks prioritizes restoration work and determines if and where trees will be planted in any given year. Students from Lee Vining and Los Angeles provide the bodies and muscle to get many of these trees into the ground quickly and efficiently. OE program participants continue to water trees throughout the summer and in following years depending on drought and local groundwater conditions. Students from Los Angeles and Lee Vining have planted and watered thousands of Jeffrey pines, lodgepole pines, and cottonwood cuttings on Rush and Lee Vining Creeks since 1994. For students, the act of planting a tree signifies a high degree of meaning and purpose, particularly when the reason for planting the tree is clearly understood.

STRAW: Students and Teachers Restoring A Watershed. *John Parodi*, Emily Allen, and Laurette Rogers. The Bay Institute, 695 DeLong Avenue, Suite 100, Novato 94945.* **parodi@bay.org** and **rogers@bay.org**

For the past 17 years, STRAW has facilitated professional quality restoration implemented by K-12 students, teachers and parents on rural and urban lands in Marin, Sonoma, Napa and Solano counties. A new film and accompanying presentation chronicles the growth of STRAW from its origins in 1992 as a fourth grade class project to restore the riparian habitat of the California freshwater shrimp into a larger project spanning the San Francisco North Bay. Over 25,000 K-12 students have participated in over 280 restorations on rural and urban creeks, installing over 30,000 native plants, resulting in the restoration of 100,000 linear feet of creek bank. STRAW sustains a network of teachers, students and restoration specialists that plans and implements restoration projects including invasive plant removal, native plant installation and biotechnical work. We are a large collaboration of schools, ranchers,

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government agencies, business and non-profits working together. With our partners, STRAW has galvanized the community and led to significant educational innovations by connecting kids with their local watersheds. STRAW is a community-based grassroots program, open to teaching and learning with others interested in similar work. Come and see how a student-driven environmental restoration project can transform both a watershed AND a community. The film includes interviews with environmental education gurus/authors Richard Louv and Roger Hart.

Mono Basin Restoration: Mono Lake Committee's Role. *Greg Reis. Mono Lake Committee, PO Box 29, Lee Vining 93541.* **greg@monolake.org**

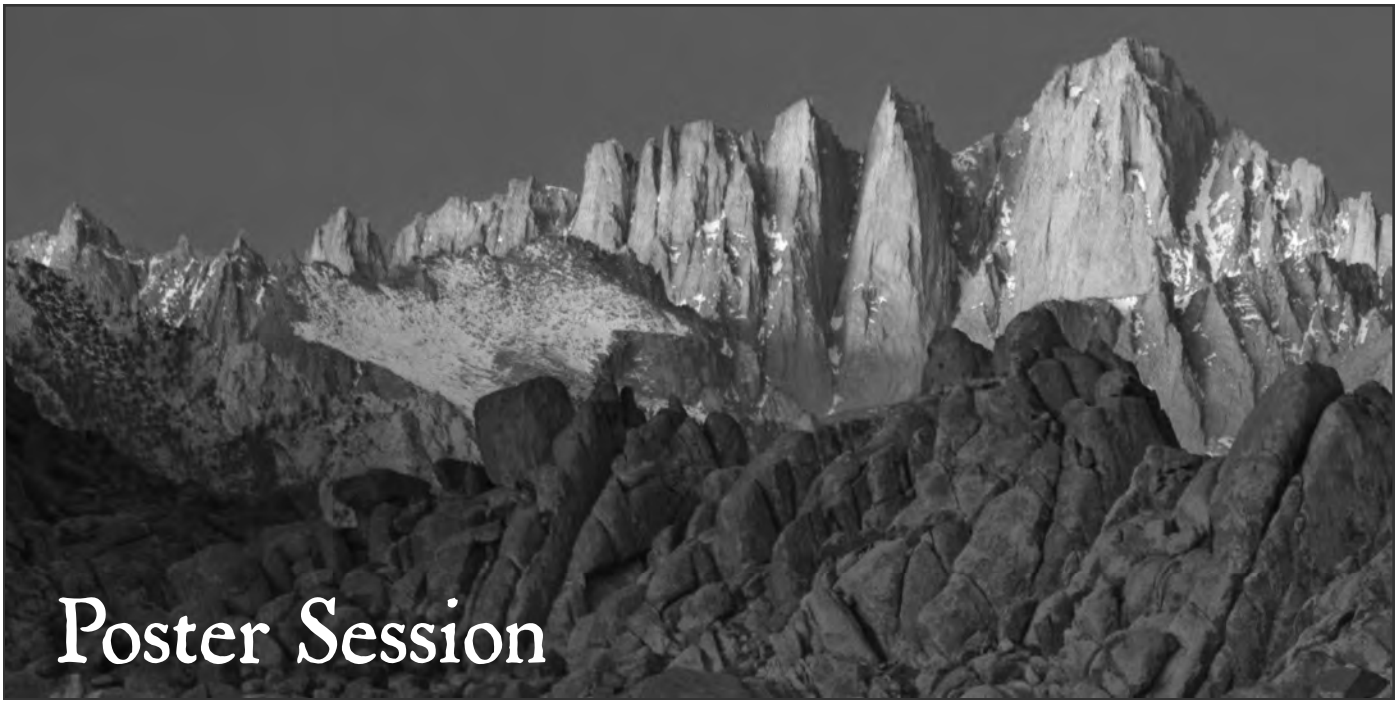
For over 30 years, the Mono Lake Committee (MLC) has been actively working on restoration of Mono Lake and its tributary streams. Although some restoration occurred prior to the 1994 State Water Board Decision that limited water exports to Los Angeles and required Los Angeles Department of Water & Power (DWP) to restore the damage caused to Mono Lake, a new phase of restoration began in 1998 with the release of Restoration Orders 98-05 and 98-07. These orders, implemented under an adaptive management process, have been guiding DWP's actions in the Mono Basin ever since. As an environmental advocacy group charged with restoration as part of its mission statement, MLC plays an active role in every aspect of restoration. Not only does MLC participate in reviewing annual monitoring reports, commenting on proposed changes to the program, and making sure that restoration actions satisfy State Water Board requirements, but MLC's involvement also goes much farther. Guided by the combination of adaptive management and re-establishing natural processes, MLC believes that restoration requires on-the-ground expertise and commitment. MLC measures groundwater fluctuations in creek floodplains, tracks snow course information and spring runoff conditions to predict peak flow events, measures lake level, organizes tree plantings and watering, and uses analytical tools such as lake forecasting models and hydrologic spreadsheet models to ensure that the Mono Basin ecosystem is restored to the greatest extent possible.

Certification for Ecological Restoration Practitioners. *John Stanley*[*1] and Michael Hogan[2]. [1]Chair and [2]Member, Society for Ecological Restoration International Ad-hoc Committee on Certification, 285 W. 18th Street, Suite 1, Tucson AZ 85701.* **jtstanley@comcast.net**

The Society for Ecological Restoration (SER) International is creating a certification program for practitioners of ecological restoration. A new corporation named the SER International Practitioners Institute (SERIPI) will administer the SER Practitioners Certification Program (PCP). SER PCP goals are to: 1) Provide practitioners of ecological restoration with the credentials needed to improve consumer confidence in the profession; 2) Improve the quality of ecological restoration projects worldwide; 3) Foster the incorporation of the principles of ecological restoration, as embodied in SER foundation documents, into the decision-making process of ecological restoration practitioners; 4) Develop a community of practitioners who are actively engaged in the continued improvement of their individual abilities and of their profession; 5) Create standards for practitioners of ecological restoration; and 6) Stimulate growth of the profession of ecological restoration. The results of a "Standards of Practice Survey" conducted in the spring of 2009 are being used to guide the design of the certification program. The SER PCP will certify practitioners based on their overall professional competence and takes into consideration their education, training, experience, and professional involvement. Three levels of certification will be offered: Certified Ecological Restoration Practitioner In-Training (CERPIT), Certified Ecological Restoration Practitioner (CERP), and Certified Senior Ecological Restoration Practitioner (CSERP). Specific requirements for certification vary depending on the level of certification. SERIPI will begin accepting applications for certification in 2011. This presentation will discuss specific elements of the program. We will also solicit input from the attendees regarding the program.

Mono, Owens, and San Joaquin Watersheds: NGO Staff and Consultants Implementing Restoration. *Peter Vorster. Staff Hydrologist for The Bay Institute and Consultant to the Mono Lake Committee and Owens Valley Committee, 3901 Balfour Ave., Oakland 94610.* **vorster@bay.org**

The technical staff and consultants to non-governmental environmental organizations (NGOs) play an integral role in the implementation of large-scale restoration projects in the Mono Basin, Lower Owens River, and San Joaquin River. These restoration projects arose out of NGO-initiated litigation, which led to settlements, court orders, and/or water license amendments that obligated the water right holders to implement restoration. In the Mono Basin, Mono Lake Committee (MLC) staff assist in implementation with activities ranging from monitoring to planting trees, in a developing partnership with the Los Angeles Department of Water & Power. As an MLC consultant, I advise staff, water board consultants and agency personnel with lake level and stream runoff forecasting, restoration operations, and serve as a de facto project historian because of my 32 years of involvement. The Owens Valley Committee has limited staff and relies on consultants to assure them that the Lower Owens River Project is carried out as stipulated. The recently-initiated San Joaquin River Restoration Project arose out of a settlement that obligates the Bureau of Reclamation to consult with the NGO settling parties on restoration operational guidelines and to implement the restoration with the advice of a Technical Advisory Committee that includes NGO staff and consultants. The ongoing challenge for NGOs is maintaining technical credibility and transforming the agencies' legal obligations into cooperative long-term working partnerships.



Poster Session

Listed alphabetically by lead presenter

Thursday, 20 May 5:00–6:45pm in the Foyer and Roma's Room. Posters will be on display for duration of conference.

Soil Influences on First-year Plant Establishment in Restoration of Retired Agricultural Land. *Margaret Bornyasz*[*1], *Jackie Higgins*[1], *Mari (Schroeder) Quillman*[1], *and Doug Sprague*[2]. [1]*ECORP Consulting Inc., 3914 Murphy Canyon Road, Suite A232, San Diego 92123.* [2]*Vulcan Materials Company–Western Division, 3200 San Fernando Road, Los Angeles 90065.* **mbornyasz@ecorpconsulting.com**

In the winter of 2009, Vulcan Materials completed installation of a 45-acre Riversidean sage scrub restoration project at the Colton Dunes Preserve, San Bernardino County, CA. Dune formations throughout the mitigation bank property provide habitat for the endangered Delhi sands flower-loving fly (*Rhaphiomidas terminus abdominalis*; DSFLF) and support other special status species. Prior to 2009, a portion of the property consisted of an agricultural field that had been actively farmed since before the 1930s. The recently retired field supported a dense mosaic of near monotypic stands of non-native herbaceous species. The purpose of the restoration project is to remove non-native vegetation and create native plant habitat. During initial planning stages, 13 exposed soil profiles (depths ranging from 53 to 100 inches) were characterized and a subset of soils was sampled for lab analysis. Botanical monitoring transects were intentionally stratified by soil type. Though the entire area received the same hydroseeding treatment, variations in cover and species distribution of first-year species appear to correspond to soil types. Overall percent cover varied significantly between locations and was below 50% in areas where sandy loam soils persist in the solum and well above 50% where coarser materials (loamy fine sands and fine sands) dominate. Similar patterns exist with shrub height and percent shrub cover; height and cover were greater in the coarser solum. Dominant species varied between transects and a mosaic pattern similar to what was observed in pre-restoration conditions has developed, suggesting soil microhabitat conditions occur and influence restoration results.

Control Options for High Elevation Populations of *Bromus tectorum* L. *Amy L. Concilio* and Michael E. Loik. Department of Environmental Studies, UC Santa Cruz, 1156 High Street, Santa Cruz 95064.* **aconcili@ucsc.edu**

Bromus tectorum L. (cheatgrass) is an invasive annual grass from Eurasia that has spread through much of the Great Basin Desert, displacing native shrub and bunchgrass communities and altering fire regimes. At higher elevations, cheatgrass populations are often patchily distributed. It is therefore likely that eradication or control of high elevation patches would be much easier to achieve than areas that are heavily invaded. This research seeks to identify control options for high elevation patches of cheatgrass in the eastern Sierra Nevada, CA. In the spring of 2009, we established 12 plots to test feasibility and success of the following options: manual pulling, manual pulling + seeding with native species, and sheet mulching. Native seeds included a mix of locally collected bunchgrasses and forbs. In spring of 2010, we will establish another nine plots to test the effectiveness of flaming for managing cheatgrass. Percent cover of cheatgrass, growth, and total number of seeds per meter squared (in the soil seedbank) were measured pre-treatment and will be measured post-treatment to quantify restoration success. An average of 1428 individuals/m^2 were present in plots pre-treatment, and 315 g/m^2 of cheatgrass was manually pulled from treated plots, on average. We will measure species composition in spring 2010 to determine success of seeding with natives. Soil seedbank samples are currently being

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grown in the greenhouse. Our results will have very practical application for land managers working on restoration of cheatgrass-invaded sites in the eastern Sierra.

Restoring Meadows in the Glass Mountains, Inyo National Forest: Challenges and Successes. *Todd Ellsworth* and Casey Shannon. Inyo National Forest, Supervisors Office, 351 Pacu Lane, Bishop 93514.* **tellsworth@fs.fed.us**

The Forest has emphasized and prioritized restoration of moist and wet meadows in the Glass Mountain area. Meadows make up approximately 1% of the land base of the Forest and are ecologically important as well as sensitive to disturbance. Disturbance can lead to loss of top soil and headcut formation, lowering the water table, and causing adverse impacts to vegetation communities and habitats. The Forest employs a variety of restoration techniques based on site specific conditions to retard headcuts. stop top soil loss, build top soil below the headcuts and raise watertables. This past year the Forest partnered with local conservation group Friends of the Inyo to protect meadows and wet areas. A side benefit was protection of aspen stands which are a priority for the Forest. Currently, the techniques employed are stabilizing headcuts, retarding soil loss and maintaining critical meadow habitat, meeting project objectives. The Forest is constantly evaluating restoration techniques to determine which are the most effective in achieving objectives. This poster will highlight the restoration areas, techniques employed, current condition and working with non-government agencies (NGOs).

Preventing Introduction of Non-native Weeds and Resource Damage During Construction in Yosemite National Park. *Victor Goldman*, Roger Putnam, and Marty Acree. Vegetation and Ecological Restoration, Division of Resources Management and Science, Yosemite National Park, PO Box 700, El Portal 95318.* **Victor_goldman@nps.gov** and **Roger_Putnam_III@nps.gov**

Resource managers at Yosemite National Park initiated a program to inspect heavy equipment used for reconstruction of utility lines, roads, and employee housing in Yosemite Valley. These construction projects brought large numbers of heavy construction equipment such as loaders, excavators, and backhoes into the Park from other environments throughout California and other States. Unfortunately, there was a high risk that this heavy equipment carried invasive non-native seeds in the dirt found on its tires, tracks, and buckets. Therefore, an inspection program was initiated to enforce the contract specifications which required construction equipment to be cleaned before entering the park. This successful program was managed by a project-funded resource monitor to ensure that natural resources were protected during construction. The resource monitor was also present at the various job sites to ensure that resource protection guidelines were followed and that unexpected impacts were recognized and mitigated as soon as possible.

Sub-alpine Meadow Restoration at Lukens Lake. *Victoria Hartman*, April Johnson* and Monica Buhler. Wilderness Restoration Program, Division of Resources Management and Science, Yosemite National Park, PO Box 700, El Portal 95318.* **victoria_hartman@nps.gov** and **april_johnson@nps.gov**

Lukens Meadow is a characteristic wet sub-alpine meadow, sensitive to degradation due to fine-textured soils and a growing season limited by snow accumulation and cold temperatures. Years of visitation to the popular Lukens Lake resulted in trampled vegetation, areas of bare ground, and multiple trail ruts in the meadow. The trail ruts act as drainage ditches, changing the natural hydrology of the wetland and altering plant communities. Subsequently, in 2008, foot traffic was redirected out of the meadow to a pre-existing trail through the nearby forest. This allowed for 2,000 linear feet of trail ruts and 3,000 square feet of bare ground to be restored to natural condition. Sturdy obstructions at either end of the trail, temporary signage, and minimal improvements done by the NPS trail crew to the pre-existing forest trail solidified the closure of the meadow area, discouraging but not preventing overall access to the meadow and lake edge. Monitoring in 2009 revealed no new signs of trail rutting, suggesting topography restoration and adequate vegetation colonization is successfully promoting water infiltration and limiting erosion.

The Man in the Mirror: Healing Inner and Outer Landscapes. *Trudy Ingram. Restoring Natures, 505 E Villanova Rd, Ojai, CA 93023.* **trudy.ingram@gmail.com**

Some restoration ecologists are beginning to talk about restoration as a reciprocal process — a mutually beneficial activity that helps heal people as well as wounded land. This mutual process is as much about restoring landscapes as it is about re-establishing healthy human-nature

relationships. However, as most work in our field remains focused on one-sided technological improvements to degraded landscapes, we continue to lose ground. In order to bring about long-lasting change, we believe it is essential that reconnecting with nature becomes a part of people's daily lives, beyond the restoration experience itself. Therefore, re-establishing human-nature relationships could be an explicit and key role of restoration ecology. Some of the ideas we explore to facilitate this shift are: (1) learning the non-verbal, non-analytical language of nature; (2) using a technique called "focusing" to make initial contact with nature; and (3) new college curricula in ecology that integrates quantitative with qualitative ways of knowing. We hope to begin a dialogue with other restoration ecologists interested in exploring and testing these ideas.

Increasing Aspen Age-Class Diversity Using Three Different Treatment Methods. *Anne Halford, Steven Nelson, and Dale Johnson*. Bureau of Land Management, Bishop Field Office, 351 Pacu Lane, Suite 100, Bishop 93514.* **Dale_F_Johnson@blm.gov**

Since 2004 several aspen grove communities that meet identified risk factors such as, 1) conifer canopy cover >25%, 2) aspen canopy cover <40%, 3) dominant aspen trees >100 years of age, and 4) sagebrush cover >10%, have been treated using three methods that include lodgepole pine thinning, prescribed fire and grazing exclusion. These projects are designed to improve and or alleviate ecological risk factors and meet BLM Desired Plant Community (DPC) and commensurate wildlife habitat improvement goals within the Bridgeport and Bodie Hills Management Areas. Monitoring, following standardized methods that are part of the state-wide Aspen Delineation Project, are being implemented to document post-treatment aspen response. These locations are also being monitored as part of a cooperative agreement with Point Reyes Bird Observatory to document avian response to these treatments. Aspen density response to all treatments is positive, and the prescribed burn treatments have resulted in the most significant post-release of aspen suckers.

Designing Cost-effective Test Plots for Adaptively Managed Restoration Projects. *Rachel Arst McCullough*[1], Monica Finn[2], Mark Grismer[3] and Michael Hogan[1]. [1]Integrated Environmental Restoration Services, Inc., PO Box 7559, Tahoe City 96145. [2]Caltrans Office of Landscape Architecture, District 3, PO Box 911, Marysville 95901. [3]Department of LAWR-Hydrology, UC Davis, Davis 65616.* **rarst@ierstahoe.com**

Large-scale restoration projects are often times undertaken without the information or data necessary to obtain the desired treatment results. Typical restoration treatments include planting and irrigation, which are not always cost effective over time, especially in poor soils. As a part of the adaptive management process, test plots were constructed to determine the most effective treatments for particular sites. A wide range of treatment and monitoring methods were implemented as part of this Caltrans-sponsored research project. This poster focuses on plant response to range of soil-based restoration techniques. A variety of soil amendments were tested for each site condition and plant cover was monitored over the course of 2-3 years. The results presented here will help in understanding the importance of incorporating the adaptive management approach in a project, especially during design.

Producing Local Native Plant Materials for Restoration. *Kathleen Nelson*[1] and Anne Halford[2]. [1]Inyo National Forest, 351 Pacu Lane, Suite 200, Bishop 93514. [2]Bureau of Land Management, Bishop Field Office, 351 Pacu Lane, Suite 100, Bishop 93514.* **kgnelson01@fs.fed.us**

Since 1997 the cooperators from the Deepest Valley Native Plant Propagation Center (managed by the BLM Bishop Field Office, California Native Plant Society - Bristlecone Chapter, Inyo National Forest and University of California) have been growing a diverse suite of native plants from locally collected plant material in the eastern Sierra. Annual plant production averages 3,500 plants from 15-20 plant genera. Methods to propagate these species include cold/moist stratification, scarification and direct sowing techniques. The plant stock is used for various projects where vehicular impacts and fire have impacted important habitats including alkali meadows, sagebrush-steppe and sub-alpine ecosystems. This eastern Sierra specific plant stock is also sold at the Bristlecone Chapter's annual native plant sale. Proceeds from the sale benefit the chapter's Botanical Grant program as well as the plant propagation center. In addition, in cooperation with the California Department of Transportation, local seed stock from various sources is maintained in a cold storage facility near the propagation center and is available for seeding or propagation, further enabling the use of local native materials in revegetation and restoration projects. Key restoration and native plant garden success stories include re-establishment of bitterbrush (*Purshia tridentata*) habitat islands in burned areas, re-establishment of desert scrub species on exposed hill-climb sites, revegetation of alkali meadows, pumice flats, and bitterbrush communities impacted by vehicles, and the display of a variety of native plants at the Mary DeDecker Memorial Native Plant Garden in Independence, CA.

Balancing Human Factors in Wildlife Habitat: Protecting and Restoring Greater Sage-Grouse Habitats in the Western Great Basin - Practical Examples from Mono County, California. *Jeff Starosta*, Casey Boyd, Steven Nelson, and Anne Halford. Bureau of Land Management, Bishop Field Office, 351 Pacu Lane, Suite 100, Bishop 93514.* **Jeffrey_Starosta@ca.blm.gov**

Like it or not, humans are a part of the natural environment and have shaped the landscapes we see today. Under the multiple use mandate of the Federal Land Management and Policy Act of 1976 (FLPMA), the Bureau of Land Management (BLM) is responsible for sustaining the health and productivity of the nation's public lands for the use and enjoyment of present and future generations. Multiple use management

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presents unique challenges to land managers who must balance wildlife habitat needs with a wide variety of other uses including recreational activities, livestock grazing, mineral exploration and fire protection. Over the past decade, the BLM Bishop Field Office has implemented an array of habitat protection and restoration projects designed to mitigate both long-term and emerging threats to sensitive wildlife species and their habitats in Mono County, California. Simple road closures in observance of the sage-grouse breeding season have proven to be effective in minimizing disturbance to both strutting grounds and critical nesting habitats in region. Changes in livestock management operations and infrastructure designs have allowed for the removal and modification of rangeland fences commonly believed to pose a hazard to sage-grouse populations in west. These and several other examples of successful habitat protection and restoration efforts implemented to date clearly demonstrate that through a combination of proactive and cooperative efforts, land managers can effectively protect and restore sensitive wildlife habitats in a multiple use setting.

Vegetation Mapping and Classification of the Palos Verdes Nature Preserve. *Lily N. Verdone* and Leslie Buena. Palos Verdes Peninsula Land Conservancy, 916 Silver Spur Road, Rolling Hills Estates 90274.* **lverdone@pvplc.org**

The Palos Verdes Peninsula Land Conservancy received grant funding through the California Department of Fish and Game's Local Assistance Grant program to produce a fine-scale, spatially and floristically accurate vegetation map of the Palos Verdes Nature Preserve (PVNP). The PVNP is part of the draft Rancho Palos Verdes Natural Community Conservation Plan (RPV-NCCP) area, and encompasses approximately 1200 acres of protected open space. The PVNP is located in the City of Rancho Palos Verdes, in southern Los Angeles County. The project area represents several biologically rare habitat types, including coastal sage and cactus scrub. In addition, the PVNP hosts several rare and endangered plant and animal species, which are classified as covered species in the RPV-NCCP. Vegetation resources were assessed through field surveys, resulting in the classification analysis of 26 vegetation alliances, 38 vegetation associations or semi-natural stands, and mapping of 583 vegetation map polygons. The results of this project are a detailed, accurate map of the vegetation in the PVNP. This information can now be used to answer questions ranging from species-specific management to targeting the most likely places to reduce fuel loads. We can now find precise location information for specific habitats of covered species, identify areas for conservation within sensitive natural communities and habitats with invasive species, restore habitat value based on various attributes, and create linkages to wildlife habitats through restoration.