



SACRAMENTO RIVER RESTORATION SCIENCE CONFERENCE

APRIL 9-10, 2007

HOSTED BY THE NATURE CONSERVANCY AND THE
SACRAMENTO RIVER CONSERVATION AREA FORUM
AT THE BIDWELL PARK ROOM, BELL MEMORIAL UNION,
CALIFORNIA STATE UNIVERSITY CHICO



Sacramento River Restoration Science Conference



Hosted By

The Nature Conservancy and
Sacramento River Conservation Area Forum



Monday, April 9 (9:00am - 4:30 pm)

Sacramento River Restoration: past, present, and future - Session Chair - Greg Golet, TNC (9:00-10:00)

9:00-9:05	GOLET, GREG	TNC	Overview of sessions
9:05-9:20	BUNDY, BURT	SRCAF	An Historical Perspective on Conservation and Restoration Efforts on the Sacramento River
9:20-9:35	WERNER, GREGG	TNC	The Uncertain Long-term Future of Riparian Habitats along the Sacramento River
9:35-9:50	CARLON, JOHN	River Partners	Building a Future for Salmon and Songbirds
9:50-10:00	questions		

10:00-10:20 *morning break*

Integrating Restoration with Human Needs - Session Chair - Tom Smith, Ayers (10:20-12:00)

10:20-10:40	LUSTER, RYAN	TNC	Use of Swales to Alleviate Flood Concerns in Restoration
10:40-11:00	GRIGGS, TOM	River Partners	A Test of a Flood-Neutral Riparian Revegetation Design
11:00-11:20	ROBERTS, MIKE	TNC	The First Application Nationwide of New Army Corps Project Policy Guidelines at Hamilton City, CA: New Opportunities for Conservation and Local Communities
11:20-11:40	SMITH, THOMAS	Ayers	Use of 2- Dimensional Hydraulic Modeling in the Planning of Riparian Restoration within Designated Floodways and Floodplains: Case Studies within the Upper Sacramento River, California.
11:40-12:00	WERNER, GREGG, Ron Unger, Vance Howard, Philip Hendricks, and Kelly Savage	TNC	Integrating Compatible Public Recreation with Ecosystem Restoration

12:00-1:00 *lunch break*

Transboundary Issues - Session Chair - Ajay Singh, GCRCD/ SRCAF TAC Chair (1:00-2:40)

1:00-1:20	EFSEAFF, D.S.	River Partners	A Case-Study of Restoration at the Del Rio Wildland Preserve: Navigating Through the Challenges Facing Riparian Restoration in the Floodplain.
1:20-1:40	GOLET, GREG, John Hunt, David Koenig, Raymond J. Bogiatto, and Gregg Werner	TNC	Do Small Mammal Pest Species' Impacts Increase on Farms when Adjoining Lands are Converted to Riparian Habitat.
1:40-2:00	LANGRIDGE, SUZANNE	UC Santa Cruz	Effect of Restored Riparian Habitat on Insectivorous Bird Foraging on Orchards along the Sacramento River
2:00-2:20	BUCKLEY, MARK	UC Santa Cruz	Negative Off-Site Impacts of Ecological Restoration: Understanding and Avoiding Conflict
2:20-2:40	SINGH, AJAY	GCRCD	Environmental Conflict along the Sacramento River: Stakeholder Perspectives on Habitat Restoration

2:40-3:00 *afternoon break*

Restoration Management Tools - Session Chair - David Siedband, Wolf and Associates (3:00-4:20)

3:00-3:20	BENDA, LEE and Kevin Andras	Earth Systems Institute	NETMAP: A Watershed Database Catalogue and Analysis Tool Kit Supporting Restoration in California
3:20-3:40	LANCE, JOHN	DWR	Library of Historical Aerial Photography for the Sacramento River from Red Bluff to Colusa (River Miles 142 to 245): An Application for Google Earth
3:40-4:00	GALANG, JEFFREY	TNC	Developing a Suitability Model for Conservation Prioritization: The Parcel Picker
4:00-4:20	SIEDBAND, DAVID	Wolf and Associates	Sacramento River Portal and the Watershed Portals Network: Using Open Source Software to Empower Conservation Efforts

Tuesday, April 10 (9:00am - 4:30 pm)

Vegetation - Session Chair - Karen Holl, UC Santa Cruz (9:00-10:20)

9:00-9:20	WOOD, DAVID and Catherine A. Little	CSU Chico	Comparison of Riparian Restoration Vegetation to Remnant "Reference" Forests along the Middle Sacramento River
9:20-9:40	LITTLE, CATHERINE, Colleen A. Hatfield, Sheli M. Wingo, Karen D. Holl, and David M. Wood	H.T. Harvey & Associates	Characterizing Hydrochory along the Middle Sacramento River, California
9:40-10:00	HOLL, KAREN, Prairie L. Johnston, and David M. Wood	UC Santa Cruz	Restoring Understory Riparian Forest Plant Species along the Sacramento River
10:00-10:20	SWAGERTY, HELEN	River Partners	Successful Riparian Restoration Results in Increasing VELB Colonization

10:20-10:40 *morning break*

Wildlife -Session Chair - Evan Girvetz, UC Davis 10:40-12:00)

10:40-11:00	HUNT, JOHN	USDA NRCS - Butte Co	Surface-Active Beetles (Coleoptera) as Indicators of Habitat Change in Riparian Restoration Efforts along the Middle Sacramento River, California
11:00-11:20	GARDALI, THOMAS and Aaron L. Holmes	PRBO	Maximizing Benefits from Revegetation Efforts: Local- and Landscape-level Determinants of Avian Response
11:20-11:40	SMALL, STACY	Univ Missouri	Conservation and Ecology of Breeding Landbirds in a Riparian Restoration Context
11:40-12:00	GIRVETZ, EVAN H. and Steven Greco	UC Davis	Landscape-level Habitat Characteristics Influencing Yellow-billed Cuckoo (<i>Coccyzus americanus occidentalis</i>) Occupancy of Forest Patches along the Sacramento River

12:00-1:00 *lunch break*

Geomorphology- Session Chair - Michael Singer, Institute for Computational Earth System Science (1:00-2:20)

1:00-1:20	GRECO, STEVEN, Alexander K. Fremier, Evan H. Girvetz, and Eric W. Larson	UC Davis	The Importance of Conserving Channel Meander Processes for Riparian Vegetation Development and Songbird Habitat
1:20-1:40	MORKEN, INGRID C., Matt Kondolf, Hervé Piégay, Monika Michalkova, Julien Levrat, Jose Constantine, and Gudrun Bornette	WRA Inc	Former-Channel Habitats of the Sacramento River: Physical/Ecological Processes and Restoration Potential
1:40-2:00	LARSON, ERIC and Elizabeth Micheli	Sonoma Ecology Center	Predicting Chute Cutoff Based on Bend Geometry, Sacramento River, California, USA.
2:00-2:20	SINGER, MICHAEL	Institute for Computational Earth System Science	Downstream Patterns of Bed- Material Grain Size in the Sacramento River and Implications for Habitat

2:20-2:40 *afternoon break*

Fish - Session Chair - John Williams, Independent Consultant (2:40-4:20)

2:40-3:00	SMITH, JIM	USFWS	Sacramento River Winter Run Chinook Salmon: Rebounding Towards Recovery
3:00-3:20	CANNON, THOMAS C. and Trevor Kennedy	Fishery Foundation of CA	Recon Snorkel Survey of the Middle Sacramento River RM 180 to 230
3:20-3:40	VINCIK, ROBERT F	CDFG	Juvenile Salmonid Emigration Monitoring in the Sacramento River near Knights Landing using Rotary Screw Traps: Managing Debris and Weather to Manage for the Protection of Threatened and Endangered Species
3:40-4:00	WILLIAMS, JOHN G.		Habitat and Hatcheries: Schizophrenic Management of Central Valley Salmon
4:00-4:20	POYTRESS, BILL	USFWS	Abundance, Seasonal, and Temporal Distribution Patterns of Age-0 Sturgeon Captured by Rotary Screw Traps at the Red Bluff Diversion Dam

POSTER SESSION - April 9 4:30 -5:30			
Wildlife	SILVEIRA, JOE, Ron Schlorff, Barry Garrison, Mike Wolder, Mike Carpenter, Jennifer Isola	USFWS	Status and Trends of the Bank Swallow (<i>Riparia riparia</i>) along the Sacramento River
Wildlife	GILBART, MEGHAN, Colleen Hatfield, Donald Miller, Marcel Holyoak, Joseph Silveira	CSU Chico	The Effects of Host Plant Quality, Soil Composition, and Associated Vegetation on Colonization Rates by the Valley Elderberry Longhorn Beetle.
Wildlife	WILLIAMS, NEAL	Bryn Mawr College	Native Bee Communities at Restored Riparian Habitat: Response of a Non-target Species to Vegetation Restoration.
Wildlife	STROHM, KRISTEN, Ron Unger	EDAW, Inc	Partners in Restoration and Agriculture: Solutions to Reduce Regulatory Constraints and Crop Damage to Neighboring Agriculture while Achieving Ecosystem Restoration Goals
Vegetation	JOHNSTON, PRAIRIE L., Karen D. Holl, David M. Wood	UC Santa Cruz	The Effect of Shading on the Survival and Growth Rate of Three Understory Herbs, <i>Artemisia douglasiana</i> , <i>Clematis ligusticifolia</i> , and <i>Vitis californica</i>
General interest	KEY, NATHAN, and John Hunt	USDA NRCS - Butte Co	The USDA Natural Resource Conservation Service: Conservation Planning, Programs, and Voluntary Landowner Incentives in the Sacramento River Watershed.
General interest	FOERSTER, KEVIN, Kelly Moroney, Joe Silveira, Jackie Ferrier, Denise Dancher, Jennifer Isola	USFWS	Sacramento River National Wildlife Refuge - Restoring and Managing Riparian and Floodplain Habitats for Natural Resources Conservation and Wildlife-oriented Public Use
Geomorphology	MINEAR, TOBY and G.Matt Kondolf	UC Berkeley	Long-term Geomorphic Effects of Dams on Rivers in the Central Valley of California: A Comprehensive and Comparative Approach
Fish	GIOVANNETTI, SARAH L. Matthew Brown, Laurie Stafford	USFWS	Chinook Spawning Area Mapping for the Clear Creek Restoration Program, 2000-2005
Fish	Alston, Naseem O., Kellie S. Whitton, and JESS M. NEWTON	USFWS	Fishery Benefits of the Battle Creek Interim Flow Program.
Restoration Management Tools	LUSTER, RYAN	TNC	The Sacramento River Ecological Flows Tool (SacEFT): A Flows and River Management Decision Analysis Tool
Applied Restoration Ecology	BLACKWELL, STEPHEN	URS Corporation	Design Protocols for Willow Fascine Bundles Including Collection and Preparation Techniques.
Vegetation	PAINE, SETH	TNC	Patterns of Vegetation Change at Restoration Sites: An Aerial Perspective

Sacramento River Restoration Science Conference

Hosted by The Nature Conservancy and Sacramento River Conservation Area Forum
April 9-10, 2007

ABSTRACTS

SESSION 1 - Sacramento River Restoration: past, present, and future

BUNDY, BURTON M. – Sacramento River Conservation Area Forum

AN HISTORICAL PERSPECTIVE ON CONSERVATION AND RESTORATION EFFORTS ON THE SACRAMENTO RIVER

Changes to the Sacramento River since the mid 1800s have significantly modified the natural river process of erosion and deposition. Shasta Dam is probably the most significant edifice to controlling the river; however, the Corps of Engineer's Flood Control projects constructed in the 1900s run a close second. Serious restoration of habitat lost from these activities and related ongoing residential and agricultural conversion of the river corridor did not begin until the 1990s. The presentation will describe early attempts at riparian forest planting, touching on some of the problems, both technical and social, and the evolution of restoration planning to what it is today. A discussion of the role that the Sacramento River Conservation Area Forum has played in that evolution, particularly the consideration of river functions and processes in restoration planning and the reluctance of local landowners to understand the benefits of publicly funded conservation efforts, will be key elements of the presentation.

Contact: Burt Bundy, Manager, Sacramento River Conservation Area Forum, 2440 Main Street, Red Bluff, CA, 96080 (bundy@water.ca.gov) 530 528-7411

WERNER, GREGG - The Nature Conservancy

THE UNCERTAIN LONG-TERM FUTURE OF RIPARIAN HABITATS ALONG THE SACRAMENTO RIVER

The remnant and restored riparian habitat communities along the Sacramento River exist in a greatly altered environment. The magnitude of this change raises important questions in regard to the long-term viability of these habitats and the species that they support. The river is subject to a greatly modified flow and flooding regime and historic meander patterns have been substantially limited by rock revetment. The succession of plant communities has been stalled in many locations and native plants are subject to competition from nonnative invasive species. Destructive events such as fire and disease threaten to destroy native vegetation in an environment where it cannot successfully regenerate. To complicate this situation, we have just begun to consider the impacts of climate change on the riparian habitat. Ecosystem restoration on the Sacramento River has advanced rapidly and great progress has been made. As we move forward, our efforts must also focus on determining and implementing strategies to keep these habitats viable over the long term.

Contact: Gregg Werner, The Nature Conservancy, 500 Main Street, Chico, CA 95928, gwerner@tnc.org, 530-897-6370 x216

SESSION 2 - Integrating Restoration with Human Needs

LUSTER, RYAN and Kelly Moroney - The Nature Conservancy, Sacramento River Project (RL),USFWS, Sacramento River National Wildlife Refuge

USE OF FLOODPLAIN TOPOGRAPHIC RESTORATION TO ENHANCE HABITAT RESTORATION AND ALLEVIATE FLOOD CONCERNS ON SACRAMENTO RIVER NATIONAL WILDLIFE REFUGE UNITS, CALIFORNIA.

The Nature Conservancy (TNC) and the US Fish and Wildlife Service's Sacramento River National Wildlife Refuge (SRNWR) have implemented three floodplain topographic restoration projects on SRNWR Units between 2003 and 2006. The goals of these floodplain topographic restoration projects have been two-fold: 1) to provide localized flood hazard reduction surrounding the SRNWR units and 2) to enhance ecosystem function on the SRNWR units. These goals are being accomplished by restoring physical processes to degraded slough channels through the use of floodplain flows. These floodplain topographic restoration projects have provided TNC and the USFWS with many opportunities such as: 1) reducing the frequency at which surrounding neighbors are inundated, 2) improve the local drainage conditions to reduce the time that flood flows take to drain from local roads, 3) provide potential fish habitat in the restored floodplains of the SRNWR units, and 5) promote the further development of restored riparian habitat within the SRNWR units.

Ryan Luster, The Nature Conservancy, 500 Main St., Chico, CA 95928, rluster@tnc.org; (530) 897-6370, ext. 213.

GRIGGS, TOM. - River Partners

A TEST OF A FLOOD-NEUTRAL RIPARIAN REVEGETATION DESIGN

In the Central Valley most rivers and streams function as floodways during high-flow events. These floodways must convey water in an efficient manner and they are the only places where physical river processes still operate. Restoration of quality riparian habitat must take place in floodways. How do we reconcile conveyance and revegetation? Two-dimensional hydraulic modeling is a planning tool that can help design revegetation plantings that will actually assist in flood-damage control. Using the O'Connor Lakes Ecological Reserve (CA Dept. of Fish and Game) riparian restoration project on the Feather River as an example, we will show how the planting design was laid out using the information about water surface elevation and water velocity generated by the model under different planting layouts. The O'Connor Lakes riparian restoration project was planted in the fall of 2005 based upon this flood-neutral design. In early January 2006 the entire project site was flooded as water moved rapidly across and through the restoration planting. Based upon a site visit less than one month following the peak of the flood, we will report on the behavior of the flood-flows relative to the planting design. The designed high-velocity corridor functioned well with sediment transport apparent. The plantings of woody species in the low velocity backwater area survived with a loss of ten percent of the individuals and only minor disruption of the irrigation hardware. Flood-neutral riparian revegetation for quality wildlife habitat can be designed within a floodway with careful planning for the hydraulic effects of flood flows.

Contact: Tom Griggs, River Partners, 580 Vallombrosa Ave, Chico, CA 95926. tgriggs@riverpartners.org.

ROBERTS, MIKE – The Nature Conservancy

THE FIRST APPLICATION OF NEW ARMY CORPS PROJECT POLICY GUIDELINES AT HAMILTON CITY, CA: NEW OPPORTUNITIES FOR CONSERVATION AND LOCAL COMMUNITIES.

Formulating conservation projects that also serve the multiple needs of local communities as well as the agricultural community is a challenge. Fortunately, the Army Corps of Engineer's is developing new policy guidelines which enable inclusion of multiple purposes within a project and provide a new vehicle to form broad-based partnerships. This presentation will provide an overview of how these new guidelines were applied for the first time nationwide to formulate the Hamilton City Ecosystem Restoration and Food Damage Reduction Project, the first project in over 20 years of study to meet the Corps' required benefit to cost ratio. The presentation will also provide an overview of the project which includes restoration of 1500 acres of riparian communities as well as construction of a 7 mile long setback levee, highlighting major milestones of the Corps' process moving towards project construction.

Contact: Mike Roberts, The Nature Conservancy, 500 Main St., Chico, CA. 95928 (mike_roberts@tnc.org) and, 554 S 1100 E., Salt Lake City, UT 84102 (MR)

SMITH, THOMAS W. - Ayres Associates Inc

USE OF 2-DIMENSIONAL HYDRAULIC MODELING IN THE PLANNING OF RIPARIAN RESTORATION WITHIN DESIGNATED FLOODWAYS AND FLOODPLAINS: CASE STUDIES WITHIN THE UPPER SACRAMENTO RIVER, CALIFORNIA

The Sacramento River Flood Control System has received considerable attention of late in regards to its ability to protect the adjacent lands and population from the 100-year flood event. At the same time progress is being made in converting marginal farming operations within the levees to native habitat. Gaining support for these projects with local boards and some state regulatory agencies has not been easy. The greatest perceived impact to the flood control system is seen to be a reduction in flow capacity by dense growth created by the restoration.

Some success in gaining local support has been achieved through the use of 2-dimensional hydraulic modeling of the existing and proposed restoration. This type of modeling can be done to a level of detail that will capture even relatively small changes (several acres), but one of the strongest points is being able to present the result in color graphic format that not only work well to demonstrate results for the planners and general public. Output in a plan view format has received a much higher level of understand of overall changes as opposed to more traditional engineering output of charts and graphs.

Contact: Thomas Smith, Ayres Associates Inc, 2150 River Plaza Drive, Suite 330, Sacramento, CA 95833, smitht@AyresAssociates.com

WERNER, GREGG, Ron Unger, Vance Howard, Philip Hendricks, and Kelly Savage, - The Nature Conservancy (GW), EDAW Inc. Sacramento, CA (RU, VH), EDAW Inc. Fort Collins, CO (PH, KS)

INTEGRATING COMPATIBLE PUBLIC RECREATION WITH ECOSYSTEM RESTORATION

Ecosystem restoration of riparian systems requires continued public support in the face of increased competition for land, water and funding. In addition to the values of biodiversity and healthy natural systems, large segments of the public look for specific benefits that affect their everyday lifestyle. They wish to see a tangible return on an investment of public funds. Compatible public recreation opportunities can meet this need and help to sustain a public constituency for ecosystem restoration. Public and private habitat managers along the Sacramento River have accordingly focused on planning for compatible recreation over the past several years. In 2006, The Nature Conservancy partnered with EDAW Inc. to develop two public recreation plans that were tied to the conservation of riparian habitat in Colusa County. These plans were developed through an intensive public engagement process, which resulted in a local consensus on these plans. This expression of local agreement was a first in an area that has not been supportive of ecosystem restoration efforts in the past.

Contact: Gregg Werner, The Nature Conservancy, 500 Main Street, Chico, CA 95928, gwerner@tnc.org, 530-897-6370 x216

SESSION 3 - Transboundary Issues

EFSEAFF, D.S. - River Partners

A CASE-STUDY OF RESTORATION AT THE DEL RIO WILDLAND PRESERVE: NAVIGATING THROUGH THE CHALLENGES FACING RIPARIAN RESTORATION IN THE FLOODPLAIN.

In 2001, River Partners received a grant to acquire a 258.5 acres property located north of Butte City, California (Glenn County). The Del Rio Wildland Preserve expands on over 12,000 acres of wildlife conservation habitat on the historic Llano Seco Rancho and is surrounded on three sides by conservation ownership (the Sacramento River National Wildlife Refuge and conservation easements on private property).

The project touches on many of the issues that affect development of restored habitat in the floodplain. We will present the project as a case study to highlight some of the challenges facing current restoration projects. The project provides lessons on: 1) addressing neighbor concerns and perceptions, 2) designing restoration to meet multiple objectives, and 3) wading through regulatory issues and misperceptions. We will discuss the impact of the Safe Harbor Agreement for the Valley Elderberry Longhorn Beetle and the challenges of securing Reclamation Board Encroachment Permits. The case history of this property provides insight into the current application of ecological knowledge and the status of the regulatory landscape for future restoration projects.

Contact: Dan Efseaff, River Partners, 580 Vallombrosa Ave, Chico, CA 95926. defseaff@riverpartners.org, 530-894-5401, ext 21.

GOLET, GREGORY H., John Hunt, David Koenig, Raymond J. Bogiatto, and Gregg Werner. - The Nature Conservancy, Northern Central Valley Office, (GG, GW) California State University Chico, Department of Biology (JH, DK, RB).

DO SMALL MAMMAL PEST SPECIES' IMPACTS INCREASE ON FARMS WHEN ADJOINING LANDS ARE CONVERTED TO RIPARIAN HABITAT?

Restoration of floodplain lands on the Sacramento River has successfully restored habitat for native wildlife. Yet local landowners have expressed concern that restoration may result in increased pest species' impacts on adjoining agricultural lands. To investigate this, we are conducting a study of small mammal distribution and abundance at four habitat types (agricultural, young restoration, older restoration, and remnant riparian) on the middle Sacramento River. Three sampling methods are being employed: live trapping, visual surveys and analyses of Barn Owl pellets. Preliminary results suggest that small mammals are highly responsive to local habitat conditions with different species showing peak abundances in different habitat types. Although certain orchard pests (especially voles) had relatively high abundances at young restoration sites, these declined as sites matured. In fact, relative abundance of small mammal pests was typically lower in older restoration sites and remnant habitats than in agricultural sites. To help control voles at young restoration sites, we recommend that Barn Owl nest boxes be erected, as voles are their most common prey. A conservation concern was the high relative abundance of exotic black rats (*Rattus rattus*), a

predator of songbird nests and roosting bats, in older restoration sites and remnant riparian forests.

Contact: Greg Golet, Northern Central Valley Office, The Nature Conservancy, Chico, CA 95928 USA; ggolet@tnc.org ; 530-897-6370 x 212

LANGRIDGE, SUZANNE M. - University of California Santa Cruz

EFFECT OF RESTORED RIPARIAN HABITAT ON INSECTIVOROUS BIRD FORAGING ON ORCHARDS ALONG THE SACRAMENTO RIVER

Research within the Sacramento River watershed has demonstrated that bird populations increase with restoration activities and that abundance and diversity of bird populations are similar in restored and remnant riparian forests. However, little is known regarding bird use on other parts of the riparian landscape. In particular, orchards cover a large part of the Sacramento River Conservation Area. These orchards could act as buffer areas for riparian forest birds. Alternatively, insectivorous riparian birds foraging on orchard habitat could act as natural enemies feeding on agricultural pests. I investigated the diversity, abundance, and foraging behavior of insectivorous riparian birds during winter 2006 on twelve orchards either adjacent to remnant riparian forest, restored riparian forest (>5yrs old), or other orchards. Preliminary results show a higher abundance and species richness of birds foraging on restored orchards, however this result is not significant. Continued observations will be important to determine whether these patterns become stronger over multiple years and more observations.

Contact: Suzanne Langridge, Environmental Studies, 1156 High Street, University of California, Santa Cruz, CA, 95064, sml@ucsc.edu, 831-325-1745

BUCKLEY¹, MARK C. - University of California, Santa Cruz and Environmental Incentives

NEGATIVE OFF-SITE IMPACTS OF ECOLOGICAL RESTORATION: UNDERSTANDING AND AVOIDING CONFLICT

Landscape-scale restoration efforts in the Upper Sacramento River Valley provide an opportunity to investigate the problem of situating large-scale ecological processes amidst other beneficial land uses. Just as negative externalities are recognized to flow from industrial areas to natural areas, restoration projects can generate negative externalities for commercial land uses. Negative externalities from industry have led to government regulation to prevent human health and environmental impacts. Expected negative externalities from restoration projects have elicited similar government constraint along the Sacramento River. Restoration organizations in the Sacramento Valley have learned to take such considerations into account when planning. Expected negative externalities from restoration that are directly the result of specific goals are likely to be more contentious than externalities arising from effects unintended by restoration planners, potential Pareto inefficiencies. External effects for which restoration planners and landowners have different expectations are important targets for research. Landscape-scale simulations of restoration activity and landowner responses via agent-based cellular automata models reveal multiplier effects of changes in sensitivity to adjacent restoration and the proportion of landowners expecting negative effects from restoration. Generally, planning that

considers landscape-scale consequences and feedbacks to site-specific decisions will generate increased net gains in natural processes.

Contact: Mark Buckley. University of California, Santa Cruz and Environmental Incentives; 1027 Emerald Bay Rd., South Lake Tahoe, California 96150; mbuckley@enviroincentives.com; 831.239.4060

SINGH, AJAY. - Glenn County Resource Conservation District.

**ENVIRONMENTAL CONFLICT ALONG THE SACRAMENTO RIVER:
STAKEHOLDER PERSPECTIVES ON HABITAT RESTORATION.**

Tension between agricultural landowners and restorationists along the Sacramento River due to the conversion of farmland to riparian forest and valley oak savanna has been caused by the perception of the increase in exposure to negative biological and physical impacts on farming and the environment, such as floods and wildlife. Some local agricultural landowners have created political opposition to the increase in riparian habitat within the Sacramento River Conservation Area. Restorationists have continued to fulfill the goals of the Sacramento River Area Handbook. This study looked at an environmental conflict management process to reduce tension between stakeholders along the Sacramento River by applying the use of environmental history and stakeholder interviews and surveys to describe the evolution of, and reasons contributing to, the conflict. The study also constructs a theoretical model of an ecological commons to describe the political and environmental interactions that contribute to the conflict as well as the difficulty in managing conflict along the Sacramento River.

Contact: Ajay Singh, Glenn County Resource Conservation District, 132 North Enright Ave. Suite B, Willows, CA 95988, Ajay.Singh@ca.nacdnet.net, (530) 934-4601 x126.

SESSION 4 - Restoration Management Tools

BENDA, LEE and Kevin Andras - Earth Systems Institute

NETMAP: A WATERSHED DATABASE CATALOGUE AND ANALYSIS TOOL KIT SUPPORTING RESTORATION IN CALIFORNIA

The intrinsic physical properties of a watershed (i.e., erosion, sedimentation, wood supply and accumulation, and habitat capability) can enhance or diminish success of restoration projects. Thus, of the thousands of kilometers of hillsides, stream channels, and roads in a large basin such as the Sacramento, how are intrinsic attributes of watersheds considered by restoration projects and how are the best sites located and prioritized? A new assessment tool, NetMap, consisting of digital watershed databases (25 base parameters) and 30 automated GIS tools, defines: 1) erosion potential, delivery, and significance, 2) aquatic habitat quality, distribution, and sensitivity, 3) in-stream wood accumulation, and 4) habitat diversity and core areas, among other facets. Search functions identify overlaps between specific hillslope and channel conditions and between roads and habitat or erosion potential. The recent application of NetMap to two million acres of the upper Sacramento and Trinity River basins funded by the Pacific Southwest Experiment Station (USFS) provides various user groups the unprecedented ability to create watershed contexts for restoration projects. A watershed context can support prioritization of 1) habitat suitability, 2) critical riparian zones, 3) habitat diversity, and 4) erosion and sediment delivery potential (hillsides and roads).

Contact: Lee Benda, Earth Systems Institute, 310 N. Mt. Shasta Blvd., Suite 6. Mt. Shasta, CA 96067, 530 926-1066, leebenda@earthsystems.net

LANCE, JOHN - State of California, Department of Water Resources- Environmental Services.

LIBRARY OF HISTORICAL AERIAL PHOTOGRAPHY FOR THE SACRAMENTO RIVER FROM RED BLUFF TO COLUSA (RIVER MILES 142 TO 245): AN APPLICATION FOR GOOGLE EARTH

The State of California, Department of Water Resources - Environmental Services Section has developed an extensive digital library of historical aerial photography. The aerial photographs are from 13 different flight lines, ranging in dates from 1947 to 1995.

The use of historic photography in our work has proved invaluable for looking at meander history, land use changes, and changes in riparian habitat. The photography and associated index have been formatted for use within Google Earth and is available to all interested parties. This application for Google Earth will showcase how to access the library, how to view the photographs, and how to use them within Google Earth.

Contact: John Lance, State of California, Department of Water Resources, 2440 Main St, Red Bluff, CA 96080, jlance@water.ca.gov, 530-528-7442.

GALANG, JEFFREY S. - The Nature Conservancy.

DEVELOPING A SUITABILITY MODEL FOR CONSERVATION PRIORITIZATION: THE PARCEL PICKER

An analysis tool has been developed by The Nature Conservancy (TNC) to aid staff in the preliminary site planning process by prioritizing parcels for protection. The tool, dubbed '*The Parcel Picker*', is a spatially-enabled extension for the ArcGIS® ArcMap application, a popular GIS program produced by Environmental Systems Research Institute. The extension utilizes a spatial analysis technique commonly referred to as a *Weighted Linear Combination*, where various factor maps are weighted and combined to produce a relative suitability score. Individual parcels can then be assigned a single suitability score. Users can choose inputs from the provided list of factors, all related in some manner to targets and threats, and produce an output map of priority areas based on a subjective assignment of weights. This process can be performed multiple times using various weighting schemes, thus allowing evaluation of the effects of different combinations of factors and weights. An important component of the model is that full documentation is written into the output itself which describes the data and weighting scheme used. Because the model is based on user-defined values and accepts an array of input datasets, the tool can be used across multiple regions.

Contact: Jeffrey S. Galang, The Nature Conservancy, 500 Main Street, Chico, CA 95928, jgalang@tnc.org, 530-897-6370 x211

SIEDBAND, DAVID S. - Wolf and Associates

SACRAMENTO RIVER PORTAL AND THE WATERSHED PORTALS NETWORK: USING OPEN SOURCE SOFTWARE TO EMPOWER CONSERVATION EFFORTS

Effective interorganizational conservation and land management requires efficient information sharing and tools and spaces that support collaboration. The Sacramento River Portal is one of the original and most progressive of such efforts, using open source software to develop a web library where resources can be shared, cataloged, and searched. Rather than attempt to be the only such initiative, the SRP focuses on creating open data that can be exchanged with other systems, and open source software that others can use to build such systems. These tools are freely available for anyone to download and use and are unencumbered by restrictive or costly licenses. Now that the library foundation of this system has been constructed, the SRP team has shifted their focus to providing effective collaboration spaces that build upon the content in the library and support planning activities. The second version of the Watershed Portals software provides the ability to host many complete project sites within a single portal. These project sites include functionality such as a secure group workspace, listserv integration, support for photo and video galleries, project blogs, through-the-web data import tools, and more. The Watershed Portals team will demonstrate these new tools and invite attendees to help shape the evolution of these tools.

Contact: David S. Siedband, Wolf and Associates, 724 N St, Davis, CA 95616, david@wolfandassociates.com 415-670-9420

SESSION 5 - Vegetation

WOOD, DAVID M. and Catherine A. Little. - Department of Biological Sciences, California State University (DMW) H.T. Harvey & Associates (CAL)

COMPARISON OF RIPARIAN RESTORATION VEGETATION TO REMNANT “REFERENCE” FORESTS ALONG THE MIDDLE SACRAMENTO RIVER

The main goal of ecological restoration is to re-create natural habitat to some pre-settlement condition. However, the degree to which success can be measured depends on the level of uncertainty about the historical composition of pre-settlement vegetation, which often is poorly known. Reference sites may be degraded due to factors such as exotic species, altered geophysical and ecological conditions, and loss of native species. Still, there is value in using reference sites to guide restoration practice and measure success, as long as these limitations are recognized. We compared plant community composition and structure in 25 remnant riparian forest plots to that of 27 plots in established restoration (seven years old or older) along the Middle Sacramento River. Remnant plots had slightly lower mean species richness (19.8 vs. 22.6), slightly higher mean percent native species (63.7% vs. 53.8%) and significantly higher mean stem basal area (175.4 vs. 76.6). Remnant plots tended to have large trees and occur in frequently flooded areas, whereas restoration plots tended to have multi-stemmed shrubs, small trees, and occur in both low-lying and higher terrace locations. When trees reach full size, and if exotic species are controlled, then restoration vegetation should reach the intended condition.

Contact: David M. Wood, Department of Biological Sciences 515, California State University, Chico, CA 95929-0515, dmwood@csuchico.edu, 530-898-6311.

LITTLE, CATHERINE A., Colleen A. Hatfield, Sheli M. Wingo, Karen D. Holl, and David M. Wood. H.T. Harvey & Associates (CAL), Biology Department, California State University Chico, (CH; SMW; DMW) Environmental Studies Department, University of California (KDH)

CHARACTERIZING HYDROCHORY ALONG THE MIDDLE SACRAMENTO RIVER, CALIFORNIA

Seed dispersal by flooding (hydrochory) is important for the regeneration of riparian plant communities, but little quantitative data exists on the Sacramento River. The objective of this study was to document the species composition and abundance of viable seeds deposited during sediment deposition in flood events along the Middle Sacramento River and to test the hypothesis that species composition and abundance differs between winter and spring flood events. In fall 2005 sediment traps were placed on floodplains within five restoration and five remnant forest sites in the one year flood-frequency interval. After both winter and spring flood events, mats were transferred to the greenhouse for germination trials. Germinating seeds were identified to species weekly where possible, and characterized by life form, native status, and wetland status. A total of 96 species were identified (48 native and 48 non-native). Results showed that there was a greater percentage of seeds deposited in the winter as compared to spring, but that the relative percentage of native individuals deposited in the spring was higher than in the winter. This research shows that there may be a difference in species composition with timing of high flow-events on the Middle Sacramento River.

Contact: Catherine A. Little, H.T. Harvey & Associates, 711 Fourth Street Davis, CA 95616, clittle@harveyecology.com, (530) 304-4544.

HOLL, KAREN D., Prairie L. Johnston, and David M. Wood. - Environmental Studies Dept., University of California (KDH), Biology Dept., California State University Chico, (PLJ & DMW)

RESTORING UNDERSTORY RIPARIAN FOREST PLANT SPECIES ALONG THE SACRAMENTO RIVER

Most riparian forest restoration projects in California have focused on restoring overstory species. The goal of this research is determine which factors most strongly affect seedling recruitment of native understory plants along the Sacramento River in order to inform restoration efforts. In fall 2005, we established experimental plots at six restoration sites of different ages to test the effects of grass competition, overstory cover, and distance to the forest edge on native understory establishment. We broadcast seeded and planted seven species (*Aristolochia californica*, *Artemisia douglasiana*, *Carex barbarae*, *Clematis ligusticifolia*, *Euthamia occidentalis*, *Rubus ursinus*, and *Vitis californica*) in December 2005. During winter-spring 2006 most plots flooded three times. By September 2006, seedlings showed relatively high overall survival given that they were not irrigated (range: *Carex* - 68% to *Euthamia* - 23%). Survival of most species was higher in older restoration sites and in plots with overstory cover. Treatments to reduce grass competition had minimal effect on survival and growth, which is likely due to extensive growth of broadleaved weeds in herbicided plots. Establishment from seeds was low (<5 seedlings/m²) for all species. We replanted some species and reseeded all species in December 2006 and will continue monitoring through fall 2008.

Contact: Karen D. Holl, Environmental Studies Dept., University of California, Santa Cruz, CA 95064, kholl@ucsc.edu, 831-459-3668

SWAGERTY, HELEN - River Partners

SUCCESSFUL RIPARIAN RESTORATION RESULTS IN INCREASING VELB COLONIZATION

One of the goals of planting elderberry shrubs (*Sambucus mexicanas*) into riparian restoration sites is to increase populations of the federally threatened valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) (VELB) habitat. However, monitoring to evaluate the success of restoring additional suitable habitats and establishing new populations has not occurred. To date, 76,000 elderberry plants have been planted on the US Fish and Wildlife Service Sacramento River National Wildlife Refuge since 1989. Although the survivorship of planted elderberry on restoration sites exceed 80 percent, no formal surveys have ever been carried out to document their use by VELB. Anecdotal accounts of VELB exit holes in elderberry shrubs in restoration units exist, but only as fortuitous observations. River Partners examined approximately 10 percent (7,600) of the planted elderberry shrubs at several Sacramento River National Wildlife Refuge units for presence or absence of VELB exit holes and in addition, the presence and absence of Argentine ants (*Linepithema humile*). Refuge units surveyed lay along 66 miles of the Sacramento River (between RM 167 and RM 233), encompassing Tehama, Butte and Glenn counties. VELB exit holes were observed in most fields containing elderberry shrubs, with some shrubs containing multiple exit holes. A total of 449 exit holes in 299 planted elderberry shrubs were observed in the selected refuge units. This

study shows the effectiveness of restoring elderberry habitat and the subsequent successful VELB colonization of these recently restored lands.

Contact: Helen Swagerty, River Partners, 580 Vallombrosa Avenue, Chico, California 95926.
hswagerty@riverpartners.org. 530-894-5401 ext. 27

SESSION 6 - Wildlife

HUNT, JOHN W. - USDA Natural Resources Conservation Service

SURFACE-ACTIVE BEETLES (COLEOPTERA) AS INDICATORS OF HABITAT CHANGE IN RIPARIAN RESTORATION EFFORTS ALONG THE MIDDLE SACRAMENTO RIVER, CALIFORNIA

Riparian restoration efforts along the Sacramento River have largely targeted creation of habitat for declining wildlife populations and restoring ecosystem functions. The objective of this study was to examine response of terrestrial arthropod assemblage to these efforts using epigeal (surface-active) beetles as a surrogate. Pitfall traps were used to conduct monthly sampling of surface-active beetles within young restoration, old restoration and remnant riparian sites. Individuals were sorted into a morphospecies collection and taxonomy determined to the highest level practicable. Cluster analysis and Non-metric Multidimensional Scaling were used to compare trap data amongst forest types at the order level and for the three most abundant beetle families sampled. ANOVA and Kruskal-Wallis tests were used to determine significant differences in monthly trap catch for each morphospecies between forest types. Several morphospecies were significantly associated with each forest type, some appearing restricted to either remnant riparian forests or young restoration sites. Analyses indicate that as restoration sites age, their assemblages increasingly resembled those found in remnant riparian forests. This study and others like it, show that terrestrial arthropods provide a sensitive and valuable measure of habitat change while generating a large amount of baseline data on poorly studied taxa.

Contact: John W. Hunt, USDA Natural Resources Conservation Service, Butte County Field Office, 150 Chuck Yeager Way, Suite A, Oroville, CA 95965, john.hunt@ca.usda.gov, 530-534-0112 ext. 117.

GARDALI, THOMAS and Aaron L. Holmes. PRBO Conservation Science (TG), Department of Fisheries and Wildlife, Oregon State University (ALH)

MAXIMIZING BENEFITS FROM REVEGETATION EFFORTS: LOCAL- AND LANDSCAPE-LEVEL DETERMINANTS OF AVIAN RESPONSE

Avian monitoring data collected at revegetated sites in the Sacramento Valley of California have demonstrated that local population sizes and species diversity of landbirds have increased in response to riparian plant community restoration. At the scale of individual restoration sites however, there was great variation in the shape and magnitude of the response, indicating that not all restoration is equal. With limited financial resources available for habitat restoration, information that ensures and/or accelerates success is needed to economize effort and maximize benefit. To evaluate factors related to variation in restoration success and guide future restorations, we examined several variables (e.g., number of shrub species planted, distance to remnant riparian habitat) that have the potential to influence the success of riparian restoration for landbirds. Our results can be applied to future restorations by predicting the relative importance of local- and landscape-level factors on avian abundance.

Contact: Thomas Gardali, PRBO Conservation Science, 3820 Cypress Drive #11, Petaluma, CA 94954, tgardali@prbo.org, 415-868-0655 ext. 38

SMALL, STACY L. - Division of Biological Sciences, University of Missouri-Columbia

CONSERVATION AND ECOLOGY OF BREEDING LANDBIRDS IN A RIPARIAN RESTORATION CONTEXT

While \$14 to \$15 billion have been invested in 37, 000+ river and stream restoration projects in North America since 1990, only 10% are monitored for biological function, although habitat improvement is the goal of many projects. This study seeks to examine factors affecting landbird demographics in the context of floodplain forest restoration on a large regulated river in an agricultural valley. Using time-lapse video equipment, I identified nest predation by agriculture-associated predators as a primary source of nest mortality in the Sacramento River Valley, California. Then, using 10 years of nest, vegetation, and hydrology data, plus GIS land cover data, I compared multiple *a priori* hypotheses to explain nest predation on two open-cup nesting species, one resident (Spotted Towhee [*Pipilo maculatus*]) and one Neotropical migrant (Black-headed Grosbeak [*Pheucticus melanocephalus*]), using an AIC model-selection approach. I then predicted nest survival rates under varying ecological conditions, based on the best-supported models. Nest predation rates on restoration and mature remnant forest sites did not differ, indicating that restoration sites are functioning at least as well as forest sites as breeding habitat, in terms of nest success. Nest predation, in addition to nest parasitism, by the Bown-headed Cowbird (*Molothrus ater*) may be a critical limiting factor for Spotted Towhees. Flood timing influences nest predation rates for Black-headed Grosbeaks, possibly by driving mammalian nest predator population cycles. This study suggests the importance of horticultural habitat restoration combined with naturalization of river flow regime to the recovery of songbird populations in California's Central Valley.

Contact: Stacy Small, Division of Biological Sciences, 105 Tucker Hall, University of Missouri-Columbia, Columbia, MO 65211, small.stacy@gmail.com

GIRVETZ, EVAN H. and Steven E. Greco - Department of Environmental Design. UC Davis.

LANDSCAPE-LEVEL HABITAT CHARACTERISTICS INFLUENCING YELLOW-BILLED CUCKOO (*COCCYZUS AMERICANUS OCCIDENTALIS*) OCCUPANCY OF FOREST PATCHES ALONG THE SACRAMENTO RIVER

The once common western subspecies of the yellow-billed cuckoo (*Coccyzus americanus occidentalis*) is now a state-listed endangered species in California. The largest remaining population inhabits riparian forests along the actively meandering sector of the Sacramento River. To identify landscape-level habitat suitability characteristics, surveys for this species were conducted in all riparian forest patches along the Sacramento River during 1999 - 2000. A fine-scale geographic information system (GIS) dataset of land cover was digitized from aerial photographs. Riparian forest habitat patches were delineated from this dataset using the GIS-based patch delineation algorithm PatchMorph. Patch characteristics including patch thickness, area of cottonwood forest, area of riparian scrub, area of other mixed riparian forest, and area of open water were calculated for each forest patch. Multiple logistic regression model selection and multimodel inference techniques were used to relate forest patch characteristics with cuckoo presence. The results show that the area of cottonwood forest in a patch was by far the most important factor determining yellow-billed cuckoo presence in a riparian forest patch. These

findings suggest that the hydrogeomorphic processes that drive cottonwood forest establishment are likely important factors affecting the future population viability of the cuckoo nesting along the Sacramento River.

Contact: Evan Girvetz, Department of Environmental Science and Policy, University of California, One Shields Avenue, Davis, CA 95616, ehgirvetz@ucdavis.edu, 530-219-8442.

SESSION 7 - Geomorphology

GRECO, STEVEN E., Alexander K. Fremier, Evan H. Girvetz, and Eric W. Larsen - Department of Environmental Design, UC Davis

THE IMPORTANCE OF CONSERVING CHANNEL MEANDER PROCESSES FOR RIPARIAN VEGETATION DEVELOPMENT AND SONGBIRD HABITAT

Conserving the processes of channel movement (meander dynamics) is a key and critical component to restoring the ecological integrity of the Sacramento River. The production of new land from channel erosion, deposition, and cutoff processes sets up the potential for primary succession by willow (*Salix* spp.) and cottonwood trees (*Populus fremontii*). The establishment or “regeneration” of these forest types has high habitat value to several conservation target species, such as the western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), a state listed endangered species. A 2000 population census of cuckoos in California found 67 mated pairs, 34 of which are located on the Sacramento River. Using a floodplain land age surface we analyzed the spatial distribution of several plant communities. We found on floodplains aged 1-9 years that willow had the highest proportional land cover (18%), and on lands aged 10-44 years that cottonwood was dominant (31-43%). Restricting the movement of channel meander dynamics, either through channel restraints (e.g. riprap) or reduced stream power through water diversions, can act to impede natural riparian forest regeneration by reducing the area of new land production. The sustainability of cuckoo habitat on the Sacramento River is dependent on channel meander dynamics to create new floodplains.

Contact: Steve Greco (segreco@ucdavis.edu), Department of Environmental Design, University of California, One Shields Avenue, Davis, CA, USA 95616, tel: 530-754-5983

MORKEN, INGRID C., Matt Kondolf, Hervé Piégay, Monika Michalkova, Julien Levrat, Jose Constantine, and Gudrun Bornette. WRA Inc.(ICM); Department of Landscape Architecture and Environmental Planning, UC Berkeley (MK); CNRS UMR-5600, Environment-Ville-Société Site ENS-Lsh, 15 Parvis René Descartes, BP 7000, 69342 Lyon Cedex 07, France (HP, MM, JL); Department of Earth Science, UC Santa Barbara (JC); University of Lyon 1, Lab Ecol Hydrosystems, Bat 403, 43 Bld 11, Nov 1918, 69622 Villeurbanne Cedex, France (GB).

FORMER-CHANNEL HABITATS OF THE SACRAMENTO RIVER: PHYSICAL/ECOLOGICAL PROCESSES AND RESTORATION POTENTIAL

Former channels, such as oxbow lakes, provide important habitats on the Sacramento River floodplain. To understand current conditions and trends in former channels, as a basis for future management decisions, we have studied historical evolution, sedimentation rates, sampled aquatic macrophytes and riparian vegetation, measured water quality variables, and observed water surface elevations in relation to high river flows in a set of 28 former channels along the Sacramento River from RM 161 to RM 237. Younger former channels (about a decade old) have sedimentation rates of 0 to 18 cm/y, while older (>100 y) former channels have rates of 1-5 cm/y. One difference can be attributed to the fact that rapidly-filling former channels will reach a higher elevation more quickly, and thus receive overbank sedimentation less frequently as they age, resulting in lower and more consistent long-term sedimentation rates. Observations of water surface elevations showed some former channels were hydrologically well-connected to the

mainstem, while others showed more subdued fluctuations, reflecting the influence of general groundwater changes but no direct surface water connection. Aquatic macrophyte diversity was greater in former channels connected to the mainstem over a wide range of flows, reflecting the importance of connectivity and water quality for macrophyte communities.

Ingrid C. Morken, WRA, Inc., 2169-G E. Francisco Blvd., San Rafael, CA 94901, ingridmorken@yahoo.com, 510-717-2731.

LARSEN, ERIC, W., Elisabeth R. Micheli. Landscape Architecture Program, Department of Environmental Design, UC Davis, (EWL); Department of Geology, UC Davis (LM).

PREDICTING CHUTE CUTOFF BASED ON BEND GEOMETRY, SACRAMENTO RIVER, CALIFORNIA, USA.

River channel meander migration and cutoff processes drive the planform morphology and habitat attributes of floodplain rivers. Measuring and planning for channel change are some of the most important challenges for managing a meandering river corridor. In addition, documenting historical patterns provides a better understanding of the forces driving river channel migration.

Channels move progressively and by cutoff processes. Both modes of channel change have been shown to be important in ecosystem health; both processes also pose challenges to planning, particularly with respect to land use and infrastructure placement. Three categories are used here to describe modes of channel migration observed on the Sacramento River: progressive migration, chute cutoff, and partial cutoff. The majority of observed cutoffs on the Sacramento River occur via chute cutoff, a channel avulsion that occurs when overbank flows are sufficient to concentrate shear stresses to a degree capable of carving a new channel across the floodplain. This study examines the hypothesis that chute cutoffs form where the centerline has reached a threshold geometry (in terms of radius of curvature, sinuosity, and entrance angle). Sequential measurements of river bend planform geometry from 7 time periods from 1904 to 1997 are used to quantify the changes in channel planform shape of the Sacramento River from Colusa to Red Bluff and to investigate the threshold geometry for chute cutoff.

The data show that geometric parameters can serve as a predictive indicator for modes (progressive migration, chute cutoff and partial cutoff) of channel change. Bends that experienced chute cutoff displayed an average sinuosity of 1.97 ± 0.1 , an average radius of curvature of 2.1 ± 0.2 channel widths, and an average entrance angle of 111 ± 7 degrees, as opposed to average values for bends migrating progressively of 1.31 ± 0.01 , 2.8 ± 0.1 , and 66 ± 1 degrees (respectively). This suggests that the likelihood of a bend being prone to progressive migration versus chute cutoff on the Sacramento River may be estimated based on centerline geometry alone for a range of channel slopes typical of the meandering portion of the Sacramento River.

Eric W. Larsen, Landscape Architecture Program, Department of Environmental Design, U.C. Davis, One Shields Avenue, Davis, California, 95616, ewlarsen@ucdavis.edu, 530-752-8336.

SINGER, MICHAEL B. - Institute for Computational Earth System Science

DOWNSTREAM PATTERNS OF BED-MATERIAL GRAIN SIZE IN THE SACRAMENTO RIVER AND IMPLICATIONS FOR HABITAT

Spatial patterns of bed-material grain size distributions in large, alluvial rivers are relevant in various disciplines including geomorphology, engineering, and aquatic ecology. Existing theory for longitudinal grain size sorting in rivers was developed using field data from primarily glacial outwash streams and those with strong connectivity between hillslopes and channels. In both cases, sediment supply is high enough such that a balance develops between sediment transport in the channel and storage on bars. This promotes the use of bulk sediment samples from bars to represent active channel transport. However, such methodology breaks down in rivers adjusting to declines in sediment supply due to glacial recession, dam blockage, gravel/sand mining, and/or bank protection. In rivers such as the Sacramento in California, bars tend to be relict geomorphic features that represent a former state of the system and their sediments may therefore be unrepresentative of current in-channel habitat distributions. Systematic data collection of bed-material grain size data from the Sacramento riverbed and comparison with existing sediments from bars reveals fundamental differences between bar and bed sediments. The newly collected channel sediments highlight aspects of longitudinal sorting that have been hitherto unrecognized. These results are directly relevant to ongoing and future restoration efforts.

Contact: Michael B. Singer, Institute for Computational Earth System Science, c/o USGS, 345 Middlefield Rd, MS 472, Menlo Park, CA 94025, bliss@bren.ucsb.edu, 650-329-4534.

SESSION 8 - Fish

SMITH, JAMES -U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office

SACRAMENTO RIVER WINTER RUN CHINOOK SALMON: REBOUNING TOWARDS RECOVERY

Winter-run Chinook have a unique life history among Chinook salmon. Annual winter Chinook salmon returns to the upper Sacramento River declined precipitously from the over 100,000 in the late 1960,s to less than 200 in 1994. The population declined for a variety of reasons with the greatest impacts likely caused by fish passage problems, water high water temperatures, and harvest. The population was first listed as “threatened” in 1989 under an emergency listing, ultimately followed with a downgraded status to “endangered” in 1994. Since 1994, the returning spawning population has steady increased with the returning spawning population reaching 17,000 in 2006. The reasons for this dramatic turn-around are also many and include improvements in environmental conditions, the development of a hatchery program, and implementation of expensive multi-agency /stakeholder restoration/recovery actions designed to alleviate fish passage problems, improve water temperatures, and decrease harvest. The future outlook for continued successful recovery towards a sustainable population status could depend on the yet-to-be felt effects of global warming.

Contact: Jim Smith. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office 10950 Tyler Road, Red Bluff, CA 96080 (Jim_smith@fws.gov) 530-529-1253

CANNON, THOMAS C. and Trevor Kennedy - Fishery Foundation of California.

RECON SNORKEL SURVEY OF THE MIDDLE SACRAMENTO RIVER RM 180 TO 230

The distribution and abundance of winter-run juvenile Chinook salmon was the subject of a recon snorkeling survey of the middle reach of the lower Sacramento River (RM 180-230) in the late summer and fall of 2004, 2005, and 2006 by the Fishery Foundation of California. Nine surveys were conducted with a team of divers. Surveys were conducted at river flows from 7,000 cfs to 13,300 cfs (Hamilton City gage). Water temperatures ranged from 13 to 17°C with the higher temperatures recorded in late summer surveys at downstream sites. Densities of juvenile winter-run Chinook salmon reached 0.5 per square feet of area surveyed. Densities were greatest along river margins in shallow water (less than 2 to 3 ft depth), low to moderate velocities (0.5-2.25 ft/s), sand and silt substrate, and moderate to high amounts of cover. Unlike spring-run, fall-run, and late-fall-run Chinook salmon juveniles that seek out backwaters in winter and spring, winter-run juvenile salmon were not observed in shallow, warm, near zero velocity backwater habitats including mouths of small tributary streams; however, native pikeminnow and non-native largemouth bass were abundant in those habitats (e.g., mouth of Pine Creek). Winter-run juvenile Chinook salmon rear in the middle river at the lowest water surface elevations of the year, thus the focus of the protection and enhancement of their habitat should be on river stages and flows for that period of the year.

Contact: Thomas C. Cannon, Wildlands Inc., 3855 Atherton Road, Rocklin, CA 95765, tcannon@wildlandsinc.com, 916-952-6576.

VINCIK, ROBERT F. - California Department of Fish & Game, North Central Region, Lower Sacramento River Juvenile Salmonid Emigration Program

JUVENILE SALMONID EMIGRATION MONITORING IN THE SACRAMENTO RIVER NEAR KNIGHTS LANDING USING ROTARY SCREW TRAPS: MANAGING DEBRIS AND WEATHER TO MANAGE FOR THE PROTECTION OF THREATENED AND ENDANGERED SPECIES.

Juvenile salmonid emigration has been monitored on the Sacramento River at Knights Landing since 1995. The site at Knights Landing provides the last monitoring point on the Sacramento River for juvenile salmonids excluding fish produced in the Feather and American rivers. Information on timing, abundance, and race composition is provided to address critical water management decisions such as limiting Delta water diversions during the presence of winter-run Chinook salmon. The timing for the presence of emigrating salmonids usually coincides with high river flow events that bring the bulk of emigration along with heavy debris and harsh weather conditions that can disable sampling equipment and make it difficult for crews to service the traps and work up the captured salmonids. The importance of keeping the rotary screw traps working during these events has brought about some unique and effective methods for the removal of debris and coping with the rapid changes in river height and flow.

Contact: Robert F. Vincik, California Department of Fish & Game, 8175 Alpine Avenue Suite F, Sacramento CA 95826, rvincik@dfg.ca.gov, 916-227-6842.

WILLIAMS, JOHN G.

HABITAT AND HATCHERIES: SCHIZOPHRENIC MANAGEMENT OF CENTRAL VALLEY SALMON

Salmon management in the Central Valley is attempting two apparently contradictory things: maintaining and restoring diverse, locally adapted populations of naturally spawning Chinook, and maintaining an industrial-scale hatchery program to support recreational and commercial fisheries. These programs seem contradictory because there are good reasons to believe that interbreeding with hatchery fish reduces the biological fitness of naturally spawning fish, and that hatchery fish may replace naturally spawning fish, rather than supplement them. This seems to be happening in the upper Sacramento River and tributaries.

Contact: John Williams. 875 Linden Lane, Davis, California 95616 (jgwill@dcn.davis.ca.us) (530) 753-7081.

POYTRESS, BILL - U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office

ABUNDANCE, SEASONAL AND TEMPORAL DISTRIBUTION PATTERNS OF AGE-0 STURGEON CAPTURED BY ROTARY SCREW TRAPS AT THE RED BLUFF DIVERSION DAM

Minimal information is known regarding larval and juvenile sturgeon emigration patterns in the Sacramento River. Rotary screw trap based juvenile Chinook monitoring activities conducted at the Red Bluff Diversion Dam (RBDD) have resulted in the incidental capture of age-0 sturgeon in each of ten years of operation. From this monitoring project, larval and juvenile sturgeon abundance and distribution patterns from production above RBDD have been obtained. Age-0 sturgeon were captured from May through August and 99.5 % were sampled with the RBDD gates in the lowered position. June and July combined represent 90% of annual sturgeon captures with July being the month of greatest emigration based on CPUV data ($\lambda = 0.018$ fish/acre-feet). Annual relative abundance estimates indicated a decreasing trend for the period 1995-1999 followed by a stable trend for the period 2002-2006. The average total length of age-0 sturgeon captured by rotary traps was 30.2 mm and ranged from 20.0 to 75.0 mm. Interestingly, all larval and juvenile sturgeon samples ($N = 296$) periodically submitted to the University of California, Davis for positive identification have been confirmed to be green sturgeon (*Acipenser medirostris*).

Contact: Bill Poytress. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, 10950 Tyler Road, Red Bluff, CA 96080 bill_poytress@fws.gov 530-529-1253

POSTER SESSION

SILVEIRA, JOE, Ron Schlorff, Barry Garrison, Mike Wolder, Mike Carpenter, and Jennifer Isola. U.S. Fish & Wildlife Service, Sacramento National Wildlife Refuge Complex (JS, MW, MC, JI), California Department of Fish & Game (RS, BG)

STATUS AND TRENDS OF THE BANK SWALLOW (*RIPARIA RIPARIA*) ALONG THE SACRAMENTO RIVER

The Bank Swallow (BASW) (*Riparia riparia*), is a colonial nesting neotropical migratory bird and California listed Threatened Species. The primary threat is loss of nesting habitat through water development, flood control, and river bank protection projects. At least, 50 percent of California's nesting population occurs on the eroding banks of the Sacramento River between Red Bluff and Colusa. The California Department of Fish and Game's BASW Research Program has included nesting population surveys, reproductive studies, banding, investigations of individual colonies, and habitat assessment. Annual colony/breeding pair surveys have been conducted since 1986. The first survey recorded the highest population at 13,170 nesting pairs; annual populations trended downward to a low of 4,990 pairs in 1998; since then populations have risen to 7,380 in 2005. Bank stabilization projects and occasional large flow releases continue to displace and destroy local colonies. Habitat restoration shows promise: following the removal of a privately constructed levee, 2,770 pairs were recorded at Sacramento River National Wildlife Refuge (NWR) in 2000. This represents the second largest colony in BASW survey history. The Sacramento River NWR Comprehensive Conservation Plan identifies cooperative research and monitoring investigations and floodplain restoration as conservation strategies for the BASW.

Contact: Joe Silveira. U.S. Fish & Wildlife Service, Sacramento National Wildlife Refuge Complex, 752 County Road 99W, Willows, CA, 95988, joe_silveira@fws.gov

GILBART, MEGHAN, Colleen Hatfield, Donald Miller, Marcel Holyoak, and Joseph Silveira. Department of Biological Sciences, CSU Chico (MG, CH and DM) Department of Environmental Science and Policy, UC Davis (MH), Sacramento National Wildlife Refuge Complex (JS)

THE EFFECTS OF HOST PLANT QUALITY, SOIL COMPOSITION AND ASSOCIATED VEGETATION ON COLONIZATION RATES BY THE VALLEY ELDERBERRY LONGHORN BEETLE

The Valley Elderberry Longhorn Beetle (VELB), *Desmocerus californicus dimorphus*, is a rare insect endemic to the Central Valley of California. Blue elderberry, *Sambucus mexicana*, is the sole host plant for the VELB and is typically a riparian associate. Significant loss of riparian habitat in the Central Valley led to the listing of the beetle as Federally Threatened in 1980. The VELB is one of three threatened species for which the Sacramento River National Wildlife Refuge (NWR) was established; to date, 94,109 elderberry bushes have been planted on the restoration sites. Despite millions of dollars spent on restoration of riparian habitats, neither the current health status of planted elderberry shrubs nor colonization rates by the VELB are well-understood. Nutrient levels of elderberry shrubs, one possible indicator of plant health, are a known correlate of VELB colonization rates. We will measure both variables for planted

elderberry shrubs to evaluate the efficacy of restoration efforts in the Sacramento River NWR. These ecological data of VELB habitat quality are essential for attaining the goal of long-term conservation of the VELB through anticipated improvements of restoration and management plans.

Contact: Donald G. Miller, Department of Biological Sciences. 240 Holt Hall, California State University, Chico tel. (530) 898-6153 FAX (530) 898-4363

WILLIAMS, NEAL M. - Department of Biology, Bryn Mawr College

NATIVE BEE COMMUNITIES AT RESTORED RIPARIAN HABITAT: RESPONSE OF A NON-TARGET SPECIES TO VEGETATION RESTORATION.

To investigate the success of current approaches along the Sacramento River at restoring non-target species, I compared bee and flowering plant communities at six restored sites and riparian remnants between Red Bluff and Colusa. Remnants contained mixtures of riparian forest and open grass/gravel and restored areas were mid-succession planted in 1997. Each site was surveyed every six weeks from late February through August 2003. Bees were netted at flowers and trapped in water-filled pans. Floral abundance was measured using quadrats. Sampling yielded 125 bee species, 91 at remnant sites and 90 at restored sites. Average richness and abundance did not differ between sites types. Thus, the restored habitats supported abundant and diverse pollinator communities within five to ten years. Despite similar abundance and richness, the composition of bee communities at restored sites differed significantly from those in remnants (MMRP, $A = 0.12$, $P = 0.003$). Communities at restored sites were not clearly nested subsets of those in the remnant fragments suggesting that many species found at restored sites arrived from habitats other than forests. Flowering plants were also distinct between restored and remnant sites, which may contribute to the differences in pollinator communities. Such baseline data are critical for assessing the response of non-target groups during restoration and regeneration.

Contact: Neal M. Williams, Department of Biology, Bryn Mawr College, 101 N. Merion Ave. Bryn Mawr PA, 19010. nwilliam@brynmawr.edu, 610-526-5091.

STROHM, KRISTEN, Ron Unger. - EDAW, Inc

PARTNERS IN RESTORATION AND AGRICULTURE: SOLUTIONS TO REDUCE REGULATORY CONSTRAINTS AND CROP DAMAGE TO NEIGHBORING AGRICULTURE WHILE ACHIEVING ECOSYSTEM RESTORATION GOALS.

Neighboring landowner concerns about pest issues and endangered species regulations often generate opposition to habitat restoration. EDAW is partnering with TNC and the Sacramento River Conservation Area Forum's Advisory Workgroup of farmers, landowners and land managers to reduce adverse effects of pests and regulations on neighboring, primarily agricultural, stakeholders while attaining restoration goals. This poster presentation evaluates potential pest and regulatory issues and examines potential solutions that enable both restoration and neighboring stakeholder goals to be met. Agreements examined include Good Neighbor Policies, Neighboring Landowner Agreements, Memoranda of Understanding, Safe Harbor Agreements, Habitat Conservation Plans, streamlined permitting, and self-mitigating restoration

design principles which reduce the risk of transboundary wildlife conflicts. Agreements are compared on 9 criteria: formality of assurances for stakeholders, level of protection for wildlife, flexibility, simplicity, level of responsibility held by restoration proponents, level of responsibility held by neighboring stakeholders, timeline to completion, length of time the agreement is binding, and financial cost. This approach may be used by both restoration proponents and neighboring landowners to identify the best tools to meet specific pest and regulatory concerns.

Contact: Ron Unger, EDAW, Inc., 2022 J Street, Sacramento, CA 94814 Ron.unger@edaw.com

JOHNSTON, PRAIRIE L, Karen D. Holl, and David M. Wood - Department of Biological Sciences, CSU Chico (PJ and DW) Department of Environmental Studies, UC Santa Cruz (KH)

THE EFFECT OF SHADING ON THE SURVIVAL AND GROWTH RATE OF THREE UNDERSTORY HERBS, *ARTEMISIA DOUGLASIANA*, *CLEMATIS LIGUSTICIFOLIA* AND *VITIS CALIFORNICA*

Habitat range in plant species is partly determined by shade and drought tolerance. Three hypotheses predict how drought and shade in combination will affect plant growth. The tradeoff hypothesis predicts the negative effects of shade will be multiplied by drought. The facilitation hypothesis predicts drought conditions will be eased by shade. The fixed hypothesis proposes the effects of drought and shade are proportionally fixed. We will test these hypotheses in a field experiment on the Sacramento River National Wildlife Refuge by exposing three riparian understory species to four irradiance levels ranging from full sun to deep shade. In December 2006, 100 seedlings of *Artemisia douglasiana*, *Clematis ligusticifolia*, and *Vitis californica* were planted in open fields at two sites on the refuge. In spring, tents will be used to create the shade treatments. Tents will be removed each fall. Survival and cover will be measured in spring and fall 2007, and 2008. Photosynthetic response will be measured throughout each growing season using a LiCor 6400. Surveys of older Sacramento River riparian restoration sites show low native understory species abundance. Knowledge of the optimum irradiance level for the target species could be used by restoration managers to select appropriate microhabitats for planting.

Contact: Prairie Johnston. 2705 Rafael Street, Chico, CA, 95973, pjohnston3@mail.csuchico.edu, 530-891-7545

KEY, NATHAN and John W. Hunt - USDA Natural Resources Conservation Service

THE USDA NATURAL RESOURCE CONSERVATION SERVICE: CONSERVATION PLANNING, PROGRAMS AND VOLUNTARY LANDOWNER INCENTIVES IN THE SACRAMENTO RIVER WATERSHED

Wildlife conservation and habitat restoration efforts within the Sacramento River watershed are largely embedded in a working agricultural landscape. This landscape serves as an important buffer to core wild lands within the Sacramento River Conservation Area (SRCA) and elsewhere in the watershed. How well this buffer functions depends, in large part, on management decisions made by private landowners. Substantial opportunities exist to improve wildlife habitat and natural resource values of the agricultural landscape by working in partnership with private landowners toward this goal. The primary function of agencies and organizations such as

the USDA Natural Resource Conservation Service (NRCS) and county Resource Conservation Districts (RCDs) is to work with private landowners to address resource concerns and improve resource conditions in a practical and economically feasible way. These goals can be accomplished using a variety of tools, including conservation planning, free technical assistance, and financial incentives offered through Farm Bill conservation programs administered by NRCS. These tools provide an important opportunity for creative partnerships to improve habitat and resource conditions on and around working agricultural lands throughout the watershed.

Contact: Nathan Key and John W. Hunt, USDA Natural Resources Conservation Service, Butte County Field Office, 150 Chuck Yeager Way, Suite A, Oroville, CA 95965, nathan.key@ca.usda.gov or john.hunt@ca.usda.gov, 530-534-0112 ext. 3

FOERSTER, KEVIN, Kelly Moroney, Joe Silveira, Jackie Ferrier, Denise Dancher, and Jennifer Isola - U.S. Fish & Wildlife Service.

SACRAMENTO RIVER NATIONAL WILDLIFE REFUGE— RESTORING AND MANAGING RIPARIAN AND FLOODPLAIN HABITATS FOR NATURAL RESOURCES CONSERVATION AND WILDLIFE-ORIENTED PUBLIC USE

Sacramento River National Wildlife Refuge (Refuge) was established in 1989 and is comprised of 10,350 acres of remnant and restored riparian and floodplain habitats, and walnut orchards and row crops. These agriculture lands, which are prone to extensive damage from frequent flooding, are being restored to native habitats. Many organizations/programs (The Nature Conservancy, River Partners, PRBO—Conservation Science, U.S. Bureau of Reclamation, State Wildlife Conservation Board, Cal-Fed) have contributed to the growth and success of the Refuge. Riparian and floodplain restoration efforts utilize the expertise of our partners, including local farmers, to design and implement habitat restoration projects using the seeds, acorns, and cuttings of local ecotypes. Over 50 research and monitoring investigations have been conducted on the Refuge by university and agency scientists. Topics include hydrology, geology, geomorphology, soils, vegetation and plant ecology, wildlife ecology and management, and economics. Results help the Refuge manage for the long-term conservation of indigenous native flora and fauna, and the enjoyment of the American public. A Comprehensive Conservation Plan guides these natural resources conservation and management programs. Selected units of the Refuge are open for wildlife-dependent public use that includes wildlife viewing, photography, environmental education, interpretation, fishing, and hunting.

Kevin Foerster. U.S. Fish & Wildlife Service, Sacramento National Wildlife Refuge Complex, 752 County Road 99W, Willows, CA, 95988, kevin_foerster@fws.gov

MINEAR, J. TOBY and G. Matt Kondolf - Department of Landscape Architecture and Environmental Planning, UC Berkeley

LONG-TERM GEOMORPHIC EFFECTS OF DAMS ON RIVERS IN THE CENTRAL VALLEY OF CALIFORNIA: A COMPREHENSIVE AND COMPARATIVE APPROACH

The downstream geomorphic effects of a dam are determined by the degree of alteration to both flow and sediment supply, which is a result of the relative size and operation of the dam. In California's Central Valley, there are sixteen major dammed tributaries arranged in parallel, each with differently sized and operated dams. Much of the restoration work in the Central Valley, as elsewhere, is currently done river by river, with little reference to conditions or ongoing restoration efforts on neighboring rivers, and without being pieced together coherently as a part of the larger-scale restoration of Central Valley rivers as a whole. Much of this piece-meal restoration occurs since no framework exists to understand the various geomorphic effects of dams. A critical need for river restoration below dams is a geomorphic framework within which to understand and prioritize individual restoration projects and the relative similarity between rivers. Using data from previous reports, hydrologic gages, and field work conducted during 2005-2007, a first-cut framework based on magnitude-frequency comparisons appears to work well when comparing the effects of different dams in the Central Valley. This is a work in progress that hopes to benefit future large-scale river restoration projects, particularly in the Central Valley, and also smaller-scale restoration efforts on individual rivers.

Contact: J. Toby Minear, 202 Wurster Hall #200, Department of Landscape Architecture and Environmental Planning, University of California, Berkeley. Berkeley, CA 94720-2000 tminear@berkeley.edu, 510-847-4454.

GIOVANNETTI, SARAH L., Matthew R. Brown, and Laurie A. Stafford - USFWS

CHINOOK SPAWNING AREA MAPPING FOR THE CLEAR CREEK RESTORATION PROGRAM, 2000-2005

Restoration actions targeted to improve salmonid spawning habitat on Clear Creek have included increased streamflow, dam removal, spawning gravel augmentation and channel reconstruction. Spawning area mapping of Clear Creek from 2000 to 2005 was used to determine if quantitative objectives have been met concerning the goal of increasing the quantity of salmonid spawning habitat in this high priority CALFED watershed. In 2002, a 1,400 ft section of stream channel was reconstructed and spawning area use increased in the new channel on average, more than 400%. In the half mile section downstream of the Saeltzer Dam site, spawning area use increased greatly due to gravel release after the dam removal and gravel augmentation near the site. Spawning area use has decreased over the five year period in a 900' section of creek due to channel degradation caused by an ongoing headcut. In 2005, a large decrease in spawning area use in 1200' section of creek may have been due to fine sediment infiltration or increased water temperatures during spawning which caused fish spawn further upstream in more suitable habitat. Redd counts were found to be strongly correlated to spawning area use ($r^2=0.954$) in the two miles upstream of a partial barrier where redd densities are low. A relationship between spawning area mapping and escapement estimates will be discussed. Spawning area mapping may be more useful than annual escapement estimates in evaluating the benefits of specific

restoration actions. Additional studies involving redd densities, egg survival and gravel quality may provide further insight into spawning habitat improvement on Clear Creek.

Contact: Matthew R. Brown, USFWS, Red Bluff Fish and Wildlife Office, 10950 Tyler Road, Red Bluff, CA, 96080, matt_brown@fws.gov, 530-527-3043.

Alston, Naseem O., Kellie S. Whitton, and JESS M. NEWTON – USFWS

FISHERY BENEFITS OF THE BATTLE CREEK INTERIM FLOW PROGRAM

The Battle Creek Salmon and Steelhead Restoration Project will increase instream flows on the north and south forks of Battle Creek, remove five dams and build new fish screens and ladders at three remaining dams. Since 1995, interim flows have been provided by CALFED, CVPIA and PG&E to provide immediate habitat improvement to sustain current natural Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead (*Oncorhynchus mykiss*) populations while implementation of the more comprehensive Restoration Project moves forward. Increased instream flows help achieve one of the CALFED goals; to restore and protect native species and their habitats. Prior to 1995, minimum flow requirements were implemented: 3 cfs in the North Fork and 5 cfs in the South Fork. Since 1995, interim flows have provided 30 cfs on both forks with the exception of the South Fork in 2001 and 2002. The Red Bluff Fish and Wildlife Office (USFWS) has evaluated the effects of the interim flows through annual barrier weir fish counts, snorkel surveys for adult salmonids, juvenile salmonid production estimates made using rotary screw traps, and water temperature monitoring. Temperature modeling results from 2003 showed that interim flows decreased the average summer water temperatures by 3.8 F in the North Fork and 5.3 F in the South Fork. The estimated three-year Cohort Replacement Rate for potential spring Chinook was greater than 1.0 in 5 of 8 cases since 1995. The ratio of “juvenile Chinook produced per redd” was highest for years when interim flows were provided on both forks. Potential negative impacts of not providing interim flows in the South Fork in 2001 and 2002 can be seen in the below-average percentage of redds in the South Fork three years later. As a result of our monitoring we have improved our methods and have made several management recommendations on Battle Creek.

Contact: Matthew R. Brown, USFWS, Red Bluff Fish and Wildlife Office, 10950 Tyler Road, Red Bluff, CA, 96080, matt_brown@fws.gov, 530-527-3043.

BLACKWELL, STEPHEN - URS Corporation

DESIGN PROTOCOLS FOR WILLOW FASCINE BUNDLES INCLUDING COLLECTION AND PREPARATION TECHNIQUES

For the past century bank protection projects have piled various kinds of rock revetment on the banks and levees of the Sacramento River. As more of the river system has become bare revetment (riprap) restoration of the ecological systems around the riverbank habitats has become a major concern. Modern analysis techniques allow for more quantified environmental stewardship, and levee projects are required through environmental permits to develop efficient ways to incorporate restoration while improving the structural integrity of our flood control systems.

One of the emerging trends is the use of live-cut native flora materials that re-sprout or “stump sprout,” creating added slope stability and increased habitat at the same time. Willow fascines are an affordable and easy to install, application. The specific attributes benefited by the incorporation of biomaterials are increase stability, growing shaded habitat, decreased entrainment, and enhanced water quality. The willow fascines bundles described here also increase suitable habitat for native fisheries, avian life, and add significantly to the restoration of the ecological functions of the entire riparian system.

Contact: Stephen Blackwell, URS Corporation 2870, Gateway Oaks Drive, Suite 150
Sacramento, CA 95833 Stephen_Blackwell@urscorp.com

LUSTER, RYAN and Mike Roberts - The Nature Conservancy, Sacramento River Project.

THE SACRAMENTO RIVER ECOLOGICAL FLOWS TOOL (SACEFT): A FLOWS AND RIVER MANAGEMENT DECISION ANALYSIS TOOL

Many current water planning efforts to balance demands on the mainstem Sacramento River do not explicitly account for some critical ecosystem components. Current attention focuses primarily on maintaining minimum in-stream flow and temperature requirements for the upper reaches to support listed fish species, or treating the Sacramento River as a conduit to control relationships between flow and salinity in the Delta. Incorporating additional attributes of the flow regime, and the manner in which they maintain the ecological function of the Sacramento River, should result in more effective water management and ecosystem restoration strategies. In response to this need, The Nature Conservancy (TNC) and its partners (ESSA Technologies Ltd. and Stillwater Sciences) are investigating linkages between river flow on the Sacramento River and various ecological targets in an attempt to improve conditions for those targets. A major component of the project is the creation of a decision analysis tool for linking physical models and datasets with 6 focal species and a suite of performance measures. Specifically, the Sacramento River Ecological Flows Tool (SacEFT) is a database centered software system for linking flow management actions to changes in the physical habitats for several focal species of concern.

The vision for SacEFT is to create software that makes it easy for specialists and non-specialists to expand the ecological considerations and science foundation used to evaluate water management alternatives on the Sacramento River. To meet this vision, the system must leverage existing physical datasets and models rather than reinventing wheels, and selectively fill in ecological gaps. Use of existing models is a key aspect of the system; this includes both common water planning tools like CalSim II as well as various ecologically oriented models such as the meander migration model developed by researchers at UC Davis. In the case of focal species, SacEFT will typically "build-in" select functional relationships from external models or studies when generating habitat/biological performance measures.

Ryan Luster, The Nature Conservancy, 500 Main St., Chico, CA 95928, rluster@tnc.org; (530) 897-6370, ext. 213.