Oral and Poster Abstracts and Speaker Bios

(sorted by lead author)

Opening Remarks:

Stacy Cepello is an Environmental Program Manager for the California Department of Water Resources in the FloodSAFE Environmental Stewardship and Statewide Resources Office, where he works in a collaborative effort with State and Federal agencies to develop the Conservation Strategy for the Central Valley Flood Protection Plan. In the past 30-years he has been involved in numerous restoration, conservation, and research projects along the Sacramento River and its tributaries; conducted and authored a number of studies for the Department; for many years was the principle science and technical advisor to the Sacramento River Conservation Area Forum; and was involved in the implementation of the FERC Oroville Facilities Settlement Agreement for a time. He has Degrees in the Biological Sciences from UC Santa Cruz and CSU Chico and attended UC Davis on a Natural Resources Fellowship.

POSTER PRESENTATION

AUTHOR: Bank Swallow Technical Advisory Committee (BANS TAC)

CONTACT: Bev Anderson (California Department of Water Resources, Beverley.Anderson@water.ca.gov)

TITLE: Bank Swallow Conservation in California**.**

ABSTRACT: The Bank Swallow (*Riparia riparia*) is a California State Threatened species that depends on natural riverine processes to create and maintain its nesting habitat. Within California, the eroding banks of rivers and streams of the Sacramento River watershed provide the most significant breeding habitat resource for the species. These remaining habitat resources are threatened by ongoing degradation from water management and flood management activities such as bank armoring. In response to these stressors, the Bank Swallow Technical Advisory Committee (BANS TAC) was formed in an effort to promote collaborative long-term conservation and recovery of the species along the Sacramento River and its tributaries, and other areas throughout California. The BANS TAC is a coalition of federal and State agencies, and research and conservation NGO's that seeks to achieve its mission through the coordination and support of monitoring, research, the development of a Bank Swallow Conservation Strategy, outreach, and education.

Oral Presentation

Bank Swallow Technical Advisory Committee (www.sacramentoriver.org/bans/), **Bradbury Michael A.** (Ca Dept of Water Resources, mike.bradbury@water.ca.gov), and **Barker Kelley** (Ca Dept of Fish and Wildlife)

Mike Bradbury is an avian ecologist and resource coordinator for the Department of Water Resources. He work has included project environmental compliance, endangered species research and conservation, and recovery strategies.

Kelley Barker has been a biologist with the State of California for fifteen years. She is currently a Staff Environmental Scientist with the California Department of Fish and Wildlife working to integrate Ecosystem Function and Flood Management planning in the Central Valley.

Bank Swallow (*Riparia riparia*) Conservation Strategy for the Sacramento River Watershed, California.

The Bank Swallow Technical Advisory Committee (BANS-TAC) is a diverse coalition of State and federal agency, and non-governmental organization personnel that promotes collaborative long-term conservation and recovery of the Bank Swallow in California. The BANS-TAC has produced a conservation strategy to protect and recover the Bank Swallow in California. Bank Swallow populations along the Sacramento and Feather Rivers have declined as natural river processes have been muted by flood control and water management activities. Since 1970, linear miles of revetment placed on the Sacramento River has increased 450%. Since 1986, the number of Bank Swallow nesting burrows counted during annual surveys have declined 40%. The conservation strategy makes recommendations to protect remaining habitat, recover nesting habitat that has been lost, provide for river flows that aid, rather than impact, the species' nesting efforts, and recover natural river processes that benefit innumerable plant, fish and wildlife species. Conservation strategy recommendations may be used for CEQA and CESA impact analysis. Presenters will discuss integration of the strategy into large-scale and regional planning efforts such as the Central Valley Flood Protection Plan.

Poster Presentation

Calo David (California Department of Water Resources, CSU, Chico Graduate Student Assistant), **Buer Koll** (California Department of Water Resources, Engineering Geologist, Retired), Hull Roy (California Department of Water Resources, Engineering Geologist), Lawrence Seth (California Department of Water Resources, Engineering Geologist)

Contact E-mail addresses: David.Calo@water.ca.gov & Roy.Hull@water.ca.gov

Sacramento River Geomorphology Atlas (2013)

Fluvial systems are complex, with fluvial geomorphology governed primarily by geology, and hydrology. The hydrogeologic-geomorphic nature of fluvial systems means bank geology, geologic control, bank protection, and storm events, and many other fluvial system variables, are intertwined. The Sacramento River Geomorphic Atlas (2013) documents historic channel variation (1896 – 2012), showing the geology, hydrology, and geomorphology within the context of the geologic control, historic meander belt, modern meander belt, and surrounding Sacramento Valley geologic units. In addition, data was presented on LiDAR based topography, USGS topographic maps, and NAIP imagery. The purpose of the atlas was (1) to define the boundary between the modern and historic meander belts, and (2) to define the geologic control boundary that governs fluvial geomorphic extent. The Sacramento River Geomorphologic Atlas (2013) was intended to enhance natural resource management decisions, primarily concerning conservation and restoration efforts along the Sacramento River. The Sacramento River Geomorphic Atlas (2013) provides a base dataset required for ongoing development of an effective Sacramento River management plan; it also identifies the relationship between bank erosion and other river processes such as riparian succession, wetlands formation, spawning gravel recruitment, and other ecological processes. In addition, the atlas can be used to assess the anthropogenic effects of bank protection, gravel mining, agriculture, and diversions on the river system geomorphology. Preliminary results of the study will be presented.

Oral Presentation

Chase, Robert D. (US Bureau of Reclamation, rchase@usbr.gov) and Seesholtz, Alicia M. (California Department of Water Resources)

Robert Chase is a Principal Investigator with the US Bureau of Reclamation. He conducts fishery investigations throughout the Central Valley on ESA listed species.

Site fidelity and emigration of adult green sturgeon (*Acipenser medirostris)* in the middle Sacramento River

On April 7th, 2006, the Southern Distinct Population Segment of green sturgeon was listed as a threatened species under the Endangered Species Act. In June of 2009, the Bureau of Reclamation (BOR) was issued a Biological Opinion (Bi-Op) for the long-term operations of the Central Valley Project and State Water Project. Pursuant to the Bi-Op Reasonable Prudent Alternatives, multiple fishery research projects were conducted utilizing acoustic tagging and monitoring technologies in the middle Sacramento River. One of the projects included the surgical implantation of acoustic transmitters in adult green sturgeon. From 2009 thru 2011, BOR along with Department of Water Resources, in research coordination with US Fish and Wildlife Service, California Department of Fish and Wildlife and University of California Davis, surgically implanted 32 adult green sturgeon in the late summer and early fall seasons roughly seven river miles upstream of Hamilton City, CA. Results currently show that green sturgeon congregate and display true site fidelity to very few areas in the middle portion of the Sacramento river for both spawning and/or holding purposes. Majority of emigration from the river to the Pacific Ocean occurred during certain storm events however some remained in the river well into the winter season.

Oral presentation

Coulon, Diane M. (California Department of Fish and Wildlife, diane.coulon@wildlife.ca.gov),

Purdy, Colin (California Department of Fish and Wildlife)

Diane Coulon, an Environmental Scientist with the California Department of Fish and Wildlife, has been with the Department for 20 years and has conducted rotary screw trap monitoring for juvenile salmonid emigration at various siteson the Sacramento River for about 10 years.

Timing and composition of juvenile salmonid emigration in the Sacramento River near Moulton Weir and near Tisdale Weir

Juvenile salmonid emigration monitoring was conducted by the Department of Fish and Wildlife on the Sacramento River at River kilometers 193 (near Tisdale Weir) and 256 (near Moulton Weir). Sampling was conducted using two 2.4 m diameter rotary screw traps (RST's). Monitoring was conducted to develop information on emigration timing and race composition of juvenile Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead trout (*Oncorhynchus mykiss*) traveling from the upper Sacramento River to the Delta.

Naturally produced Chinook salmon and steelhead trout were the target species, but all fish species captured were recorded. Draft data summaries of catch and fishing effort from this project were sent daily via e-mail to working groups involved in State Water Project and Central Valley Water Project operations. Data summaries were distributed in conjunction with data collected at the Knights Landing juvenile monitoring location. Distribution groups for these data included the Data Assessment Team and Delta Operations for Salmon and Sturgeon (DOSS). Under the Operations Criteria and Procedures Biological Opinion, DOSS shall provide advice to National Marine Fisheries Service, and the action shall be vetted through the Water Operations Management Team standard operating procedures regarding data-related triggers for changes in water project operations.

From July 2010 through March 2011 a total of 4,516 juvenile salmon were captured at the Moulton Weir site, of which 4,199 were unmarked salmon and 317 were adipose fin-clipped (ad-clipped) salmon. There were 118 steelhead captured.

From July 2010 through June 2012 approximately 24,097 juvenile salmon were captured at the Tisdale Weir site, of which 22,333 were unmarked salmon and 1,764 were ad-clipped salmon. There were 120 steelhead captured.

Poster Session.

Jack Anthony "Tony"Danna (DWR, Floodway Ecosystem Sustainability Branch, FESSRO jack.danna@water.ca.gov); Matt Reeve (DWR, Delta Conveyance Fish Science)

Tony Danna works in the Floodway Sustainability Branch, FloodSAFE Environmental Stewardship and Statewide Resources Office in the Department of Water Resources. He is a member of Conservation Strategy Team developing the Central Valley Flood Protection Plan and is leading the agricultural outreach coordination for the Conservation Strategy.

"Listening to Farmers about Floodway Conservation."

Most of the Department of Water Resources Central Valley Flood Protection Plan (CVFPP) Statewide Planning area is located in rural agricultural (Ag) communities whose participation is critical in the planning & implementation of the Conservation Strategy. The Ag interviews were done to develop a dialogue with these Ag communities; to listen to their ideas, proposals, & concerns regarding flood control planning. The individuals interviewed for this Ag Report represented a broad range of Ag interests and a much broader number of people from their organizations and stakeholder. The goal of this effort was to keep farmers engaged with the conservation strategy planning; improve funding approaches; assist the Ag community in developing wildlife friendly practices; and identify more ways to assist willing farmers into conservation practices. This poster highlights many of the interview findings such as recent changes in the Ag economy making it more difficult to encourage farmer's involvement in ecosystem restoration projects; possible incentives to landowners to motivate their involvement, including project design; using Ag operations already in place to establish and maintain the restoration work; utilizing existing Ag organizations to pursue outreach efforts; conducting outreach early in any planning process; utilizing local entities to oversee all permit compliance responsibilities; looking for opportunities to do restoration work on marginal farmland with willing landowners; and encouraging the creation of NRCS/RCDs "farm plans". The next DWR steps are to incorporate these findings into the foundation for future engagement efforts between staff and the Ag community. Though there are a number of challenges to overcome, a better understanding of what those challenges are is an important first step toward developing a strategy to address them.

Oral presentation

Derugin Vasilissa V. (San Francisco State University, vderugin@sfsu.edu), Lebuhn Gretchen (San Francisco State University, Department of Biology), Silveira Joseph (U.S. Fish and Wildlife Service), Golet Gregory H. (The Nature Conservancy), Connor Edward (San Francisco State University, Department of Biology)

Lissa Derugin just defended her Masters Degree in Biology at San Francisco State University. She is currently searching for a PhD lab or research opportunities.

Response of large mammalian predators to riparian corridor restoration in the Sacramento River National Wildlife Refuge.

Growing awareness of the ecological implications of habitat fragmentation has sparked efforts to restore connectivity between isolated habitat patches. For this purpose, habitat conservation initiatives increasingly focus on the restoration of "corridors," parcels of land that promote the connectivity necessary for organisms' movement. Most studies of organisms' responses to corridor restoration focus on species at the lower trophic levels; top predators (often, keystone species) have received less attention.

Riparian corridor restoration in the Sacramento River National Wildlife Refuge provides an opportune setting to investigate the use of a corridor by large mammalian predators. In Colusa, Glenn, and Tehama Counties, we investigated mammalian predator use of 16 riparian corridor sites that varied in age since restoration. We used remote cameras to document predators' habitat preference, assessed by species richness and detection frequency. Top predators and the predator community at large tended to favor restored forests over remnant forests, and young restored forests over old restored forests. This trend persisted even when data from variable seasons and climatic conditions were pooled, although habitat selection was more often significant in our wet sampling year than in our dry sampling year and in the cold seasons than in the warm seasons. Our study suggests that restoration age affects predator community diversity and activity levels. Incorporating earlier successional vegetation in corridor restoration strategies and maintaining river processes that promote early successional vegetation growth may prompt predators' return to restored locations.

Oral presentation

Dettling Mark D. (PRBO Conservation Science, mdettling@prbo.org) and Seavy Nathaniel E. (PRBO Conservation Science)

Mark Dettling is an Avian Ecologist with PRBO Conservation Science, where he has worked with Yellow-billed Cuckoos along the Sacramento River for the past four years. He received his Master's degree from Cornell University in 2005 and has worked at PRBO for last 7 years.

Yellow-billed Cuckoos along the Sacramento River: No evidence for population responses to riparian forest restoration

One of the original motivations for the restoration of the Sacramento River's riparian forests was to provide breeding habitat for the Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*). The Yellow-billed Cuckoo is a migratory bird species that breeds in riparian forests in the western United States and winters in South America. Population declines have led to its status as a candidate for federal protection and it is listed as a California state endangered species. Key to recovery is a viable population along the Middle Sacramento River, one of only three remaining breeding populations in California. In 2010 and 2012, we conducted extensive surveys of the main stem of the Sacramento River from Colusa to Red Bluff to develop an accurate and up-to-date population estimate. We detected 18 individual Yellow-billed Cuckoos in 2010 and 10-12 in 2012 which represents a further decline from past estimates. This continued population decline, in spite of a substantial increase of riparian forest suggests factors other than habitat loss may be driving the decline. Alternative hypotheses for the decline include, but are not limited to: wintering area habitat loss and degradation, migratory stop-over habitat loss, indirect effects of agricultural insecticides, indirect effects of disrupted hydrological function, and increases in predator populations. Our current inability to distinguish among these hypotheses points toward the need for more information on what this species can tell us about Sacramento River ecosystems.

Poster presentation

Dolan, Jane (Sacramento River Conservation Area Forum, jdolan@water.ca.gov), Strachan, Susan (Sacramento River Conservation Area Forum), and Irwin, Rob (Sacramento River Conservation Area Forum).

Developing a Programmatic Safe Harbor Agreement for the Sacramento River – Keswick to Verona.

The Sacramento River Programmatic Safe Harbor has mutual goals of protection of the continuation of routine typical farming practices and fostering voluntary landowner conservation activities for the benefit of covered species. Under this program, landowners will enter into agreements with the Sacramento River Conservation Area Forum (Forum). A Safe Harbor Agreement is a voluntary agreement in which a willing landowner receives formal assurances under the federal Endangered Species Act that covered actions (including farming practices) which contribute to the recovery of protected species will not result in additional regulatory liability. Safe Harbor Agreements provide both landowner and conservation benefits. The Forum has been working with landowners, elected officials and the U.S. Fish and Wildlife Service to develop a safe harbor agreement that protects federally listed threatened and endangered species while addressing private landowner concerns. The process began with two competing visions: the U.S. Fish and Wildlife Service was focused on its regulatory approaches and requirements and local landowners were initially opposed to the program viewing it as another government mandate interfering with agriculture. The conflict was addressed by identifying underlying interests and focusing on points of intersections between those interests. The Forum used its structure and Board of Directors to identifying the critical interests of private landowners: landowner-directed decision making, confidentiality in the program and neighboring landowner concerns. The Forum worked with the U.S. Fish and Wildlife Service to provide technical assistance, program guidance and criteria, and interagency coordination and commitment to work through the program, instead of emphasizing their regulatory mandates. These efforts resulted in a program that is acceptable to both landowners and the Service and will be implemented in cooperation with both.

Oral Presentation

Authors: **Earley, James T.**, Brown, Matthew R. and Schraml, C. Michael, U.S. Fish and Wildlife Service, Red Bluff, California; james_earley@fws.gov

Jim Earley has worked on salmonid monitoring and restoration projects for both the California Department of Fish and Wildlife and currently the U.S. Fish and Wildlife Service. His expertise is in using rotary screw traps to monitor juvenile salmonids in tributaries to the Sacramento River.

What moves you? Clear Creek Juvenile Salmon 24-hour Passage Timing Studies 2012-2013.

Abstract: During the 2011-2012 and 2012-2013 rotary screw trapping seasons, we conducted studies on fall Chinook Salmon to; 1) identify daily temporal passage, 2) identify if particular environmental variables contribute to fish passage, and 3) determine if fish passage is proportionate to flow increases. We intend to use the results to assist us in estimating fish passage during times where traps are not fishing (i.e. excessive high flows). In 2011-2012 we sampled our traps hourly for 24-hours and caught 85% of Chinook between 1900 and 0000. Catch peaked daily in a three hour period from 1900 to 2200 and did not shift with increasing day length. In 2012-2013 we shortened the sampling window generally to the hours between 1700 and 0700, included monitoring spring Chinook passage at our upper trap location and included sampling on Battle Creek. The overall diel pattern during 24-hour sampling did not change throughout the season and between years on Clear Creek. Preliminary Battle Creek data suggest that passage timing may peak later in the night. Both Chinook and steelhead rainbow trout responded more to natural flow events when compared to artificial pulse flows. Although daily catch results suggest that Chinook are holding with incoming storms and migrate after the peak flow we found no direct correlation to barometric pressure or flow changes. However, our small sample size of storm events may have made it hard to detect this relationship. We will continue to evaluate other environmental cues such as turbidity, temperature, lunar phase and other light effects on migration. We would like to be able to identify if any of these environmental factors better explain annual differences in passage.

Oral presentation

Frediani, Adrian F. (The Nature Conservancy, afrediani@tnc.org), Joe Silveira (United States Fish & Wildlife Service)

Adrian Frediani is the project manager for The Nature Conservancy's Sacramento River Project. She manages TNC's real estate interests along the river and supports the habitat restoration program.

Wildflower restoration at Sacramento River National Wildlife Refuge

The Nature Conservancy (TNC) and U.S. Fish & Wildlife Service (USFWS) have been working together for nearly 25 years to increase biodiversity within the Sacramento River National Wildlife Refuge (SRNWR) through horticultural habitat restoration. While the refinement of herbicide application and native grass seeding has produced understory and grassland restorations dominated by native grasses, the result is large monocultures of a few native perennial grasses. Each grass species plays a role in weed control and provides native cover. However, because these grasses have similar growth habits and phenologies, they contribute marginal improvement to structural complexity and offer limited resources for wildlife. Wildflowers create variation in habitat structure and provide food sources in the form of pollen, nectar, seeds, foliage, and insect (flower visitor) prey. Planting wildflowers with a range a life histories makes these resources available for longer periods of the growing season. Including wildflowers in grassland and understory restoration seedings will improve habitat quality and increase wildlife diversity. Selective herbicides can target either broadleaves or grasses, which allows land managers to suppress weedy broadleaf species while newly seeded native grasses are establishing. The inclusion of native broadleaf species in understory and grassland restorations limits the options for curbing the competitive pressures from non-native plants. In the floodplain, lighter soils with shallow A and B horizons tend to support native wildflower species, while weedy non-native plants have generally less robust populations. Therefore, the assessment of existing plant communities and edaphic properties of potential wildflower restoration sites is critical to the successful establishment of diverse floodplain understory and grassland restorations. Seeding strategies based on restoration site edaphic and weed conditions are being explored, while we continue to use local ecotypes to the extent possible to increase restoration success and conserve natural diversity.

Poster presentation

Garcia, Dawn – (Contract Biologist, mel.dawn@sbcglobal.net), **Hatfield, Colleen** (California State University Chico, Department of Biological Sciences chatfield@csuchico.edu), Silveira, Joseph (US Fish and Wildlife Service), Schlorff, Ronald (CA Department of Fish and Wildlife-retired), and Henderson, Adam (CA Department of Water Resources)

Revisiting the Sacramento River, California Bank Swallow (*Riparia riparia*) Colony Inventory database: 1986-2010

The Bank Swallow (*Riparia riparia*) is a key indicator of riparian health because of its nesting habitat requirement of vertical banks created by natural river process. In California, the swallow is listed as a state threatened species with documented population declines since the late 1970's. Annual surveys for Bank Swallow colonies along the Sacramento River, where 70-90% of the state's population nest, were initiated in the early 1980's and data was collected annually starting in 1986. From 1986 through 1998 colonies were recorded by river mile on river atlases or in field notes. Beginning in 1999, colonies were documented with GPS technology providing more accurate location along the River. We were awarded funding to provide a detailed quality assessment and spatial rectification of 23-years of annual Bank Swallow monitoring data on the Sacramento River spanning multiple forms of data collection, collectors and variation in fine spatial resolution. Tasks included creating a spatial database with GIS program ArcMap, NAIP imagery and DWR modeled Sacramento River channels, based on early colony locations recorded on atlases. We compiled and compared raw field notes, annual survey reports, and a variety of documents to describe colony attributes. Merging with the previously rectified geo-referenced data (1999-2010) resulted in a 23-year quality assured dataset which will provide insights into colony spatial dynamics and habitat selection for the species. Though the project presented a number of challenges in assuring data quality and integrity, it was critically important as it is rare to have long-term population data for a key indicator species. Furthermore, the dataset is essential to ensure integrity in future research using the legacy data and to inform resource management policies on the Sacramento River, with the intent to retain and increase Bank Swallow habitat, resulting in benefits to the entire riparian ecosystem.

Oral Presentation

Thomas Gardali (PRBO Conservation Science; tgardali@prbo.org), Nathaniel E. Seavy (PRBO Conservation Science), John J. Parodi (PRBO Conservation Science), Leia Giambastiani (PRBO Conservation Science), and Stephanie C. Nelson (PRBO Conservation Science)

Tom Gardali is the Director of the Pacific Coast and Central Valley Group at PRBO Conservation Science. Tom's research interests are broad and include guiding and evaluating ecological restoration, understanding the impacts of climate change on birds and ecosystems, and the conservation of migratory species. Tom has been working along the Sacramento River as far back as 1993 and as recent as two weeks ago.

Climate-smart ecological restoration: framework and lessons learned from a coastal California stream

The science and especially the practice of ecological restoration must address climate change. Although there has been increasing research on modifying restoration goals away from historic baselines and toward dynamic systems, little on-the-ground guidance has been provided on how to address climate change and associated uncertainty. We define climate-smart ecological restoration and identify five key principles: (1) look forward but don't ignore the past, (2) consider the broader ecological context, (3) build in ecological insurance, (4) build evolutionary resilience, and (5) include the human community. We then test these principles by using them to design and implement a climate-smart riparian restoration project alongside a traditional design. We found that it was relatively easy to modify our planting palette to address key climate change issues in our region (e.g., increased drought) and globally (e.g., plant-animal phenological mis-matches). Our climate-smart design had more plant species with greater tolerance for environmental conditions likely to occur due to climate change than the traditional design. Furthermore, the climate-smart design contained more species that provided a source of food for wildlife for more months of the year. We found that with the current state of scientific knowledge and the guidance provided by our definition and principles, ecological restoration can be modified to address climate change relatively easily.

Oral presentation

Gilbert Michelle (PRBO Conservation Science, mgilbert@prbo.org), Seavy Nathaniel E. (PRBO Conservation Science), Gardali Thomas (PRBO Conservation Science), and Hickey Catherine (PRBO Conservation Science)

Michelle Gilbert is an Avian Ecologist with PRBO Conservation Science. She lives and works in her focal area, California's Central Valley.

Regional Monitoring of Restoration Outcomes on the Sacramento: the Central Valley Floodplain Forest Bird Survey

Initiated in 2012 by the Migratory Bird Conservation Partnership and led by PRBO Conservation Science, the Central Valley Floodplain Forest Bird Survey is designed to produce population estimates for Central Valley Joint Venture (CVJV) focal riparian species, by comprehensively sampling riparian forests along the Sacramento and San Joaquin Rivers. This monitoring program incorporates historically surveyed (legacy) transects and a spatially-balanced random sampling effort, to calculate species-specific density estimates. We successfully implemented the first year of this monitoring effort in 2012, surveying over 350 point count locations. We estimated densities for five CVJV focal species for the Sacramento Valley and San Joaquin Valley using data from the regional sites, and compared them to established conservation targets. In 2012, Song Sparrow and Spotted Towhee density estimates exceeded CVJV population targets; densities for three other focal species were near or below targets. Over time, we can examine density trends to determine whether populations are stable, declining, or increasing. Thus, our monitoring program is directly applicable to informing restoration programs and gauging their success, as well as improving and updating regional conservation targets. Using bird data from 244 legacy sites collected between 2002 and 2012, and information about time since restoration, we plotted trends of species densities as restored riparian sites matured. Two focal species, Spotted Towhee and Black-headed Grosbeak, show increasing trends in density with restoration age in the Sacramento Valley. By assessing changes in riparian bird populations throughout the Central Valley, we can provide stakeholders with information vital to adaptively

manage the region and ensure the long-term persistence of birds and other riparian-dependent wildlife.

Oral presentation

Gregory H. Golet (The Nature Conservancy, golet@tnc.org), David L. Brown (California State University Chico), Melinda Carlson (California State University Chico), Thomas Gardali (PRBO Conservation Science), Adam Henderson (California Department of Water Resources), Karen D. Holl (University of California Santa Cruz), Christine A. Howell (PRBO Conservation Science), Marcel Holyoak (University of California Davis), G. Mathias Kondolf (University of California Berkeley), Eric W. Larsen (University of California Davis), Ryan A. Luster (The Nature Conservancy), Charles McClain (University of California Santa Cruz), Charles Nelson (California State University Chico), Seth Paine (The Nature Conservancy), William Rainey (University of California Berkeley), Zan Rubin (University of California Berkeley), Fraser Shilling (University of California Davis), Joseph G. Silveira (US Fish and Wildlife Service), Helen Swagerty (River Partners), Neal M. Williams (University of California Davis), and David M. Wood (California State University Chico).

Greg Golet works as an ecologist for The Nature Conservancy of California's Central Valley and Mountains region. He works to resolve scientific uncertainties to inform conservation, and coordinates research to evaluate ecosystem response to management.

Successes, Failures and Suggested Future Directions for Ecosystem Restoration of the Middle Sacramento River, California

Large-scale ecosystem restoration projects seldom undergo comprehensive evaluation to determine project effectiveness. Consequently, there are missed opportunities for learning and strategy refinement. Prior to our study, monitoring information from California's middle Sacramento River had not been synthesized, despite restoration having been ongoing since 1989. Our assessment was based on the development and application of 42 quantitative ecological indicators. These indicators were used to characterize the status of terrestrial and floodplain resources (e.g., flora and fauna), channel dynamics (e.g., planform, geomorphology), and the flow regime. Indicators were also associated with specific goal statements of the CALFED Ecosystem Restoration Program. A collective weight of evidence approach was used to assess restoration success. Our synthesis demonstrates good progress in the restoration of

riparian habitats, birds and other wildlife, but not in restoration of streamflows and geomorphic processes. For example, from 1999-2007, there was a >600% increase in forest patch core size, and a 43% increase in the percent of the river bordered by natural habitat >500 m wide. Species richness of landbirds and beetles increased at restoration sites, as did detections of bats. However, degraded post-Shasta Dam streamflow conditions continued. Relative to pre-dam conditions, the average number of years that pass between flows that are sufficient to mobilize the bed, and those that are of sufficient magnitude to inundate the floodplain, increased by >100%. Trends in geomorphic processes were strongly negative with increases in the amount of bank hardened with riprap, and decreases in the area of floodplain reworked. Overall the channel simplified, becoming less sinuous with reduced overall channel length. Our progress assessment presents a compelling case for what needs to be done to further advance the ecological restoration of the river. The most important actions to be taken relate to promoting river meander and restoring components of its natural flow regime.

Oral Presentation

Greco Steven E. (University of California Davis, Department of Human Ecology, segreco@ucdavis.edu)

Professor Steven Greco teaches ecology, GIS, and conservation planning at the University of California, Davis. He has been studying the Sacramento River for 27 years and has published 14 articles and 7 reports about the river.

Modeling yellow-billed cuckoo habitat change from 1952 and 1987 on the Sacramento River (RM 155-234)

The yellow-billed cuckoo (*Coccyzus americanus*) is a neotropical migrant that is listed as an endangered species in the state of California. The largest remaining population of cuckoos (<100 individuals) in the state is located on the middle Sacramento River and this 'distinct population segment' is currently a candidate for listing under the federal Endangered Species Act. An analysis of two time periods (1952 and 1987) of a 127-km study reach of the river documented creation, spatial shifts, and loss of cuckoo habitat patches due to fluvial geomorphic processes, vegetation recruitment, succession, and agricultural land development. The spatial co-occurrence of riparian vegetation on floodplains <65 years old was used to identify sub-patches of cottonwood forest (*Populus fremontii*), a preferred habitat element of cuckoos, within larger patches of contiguous riparian forest. Results indicate only 15% of the habitat sub-patches identified in 1952 were coincident with those in 1987 and 27% of the sub-patches delineated for 1987 emerged anew and independently of the 1952 patches; the remaining 83% formed by shifting adjacent to the patches from 1952. The modeled 1987 sub-patch data were used to test the degree to which the surrogate variable “floodplain age” can predict the presence or absence of yellow-billed cuckoos using four years of observation data (1987-1990) and it was found that 79% of patches were correctly predicted for cuckoo presence or absence. The commission error was 7% and the omission error was 14%. These findings suggest that long-term maintenance of the yellow-billed cuckoo shifting habitat mosaic will require channel meander (e.g. bank erosion and point bar deposition) and natural regenerative vegetation processes. Strategies to achieve this objective include removal of riprap (bank revetment) that prevents channel meander, allowing or engineering channel cut-offs, and efforts to naturalize the annual hydrograph.

Scott Gregory is a Biologist with over 14 years of combined experience conducting fish and wildlife surveys, botanical surveys, forest inventories, and quantification of forest-level environmental processes such as carbon sequestration and air quality improvement using computer modeling. He holds a B.S. in Biology and a M.A. in Geography/Urban Planning, both from California State University, Chico, and is also a Certified Arborist with the International Society of Arboriculture. Scott works for North State Resources in Chico.

Oral Presentation

Griggs, F. Thomas (River Partners, tgriggs@riverpartners.org), Lorenzato Stefan, Riparian Habitat Joint Venture, California Department of Water Resources.

Dr. Griggs obtained his B.S. in Biology from California Polytechnic University, Pomona, and his M.S. in Botany from C.S.U. Chico, and his PhD. from U.C. Davis, focusing on ecology. He has over 25 years of experience in riparian restoration. Dr. Griggs' pioneering efforts in restoration ecology has contributed to the success of numerous projects throughout California. As a Senior Restoration Ecologist with River Partners since 2002, Dr. Griggs supervises and develops intricate flood tested plant designs based upon collaboration with Department of Water Resources engineers and modelers.

Riparian Vegetation Structure and Flood Management

The rivers that support quality riparian wildlife habitat in the Central Valley have typically been managed as floodways to protect the Public from catastrophic flooding. Over time the river ecosystems have been modified by projects intended to provide flood protection in a way that has diminished the capacity of the river to support nature. Today new laws and new understanding create a need to restore some of the lost natural functions of our rivers and floodplains. Addressing this need requires that we blend our understanding of river ecology with our flood management tools, particularly our flood models that are the basis of floodway design. We can look at how plants affect flow paths of water and indentify plant types that help achieve flood risk reduction goals. We can then insert these plant characteristics into the flood models to design floodways that better support nature while providing for public safety.

A key parameter used in flood models to describe vegetation is the roughness factor. Riparian vegetation in the floodway creates flow resistance.. From the perspective of hydraulic roughness all vegetation is not created equal – plants exhibit low, medium, and high flow resistance. Working with MBK Engineers, River Partners has developed roughness values for native plant communities at the O'Connor lakes project on the Feather River in the Central Valley. What we learned is roughness is only an issue in high velocity areas of the floodplain. Results from a study in a large flume showed that four species of flexible-stemmed plants – Sandbar willow, blackberry, rose, mulefat – were able to lay over in a big flood, protecting the soil from erosion without limiting the capacity of the channel to convey water. The results suggest we can place these plants in our floodways in specific locations that help with flood conveyance and also have them available to enhance the ecosystem.

LONG TERM MONITORING AND ECOLOGICAL PERFORMANCE OF HORTICULTURAL RIPARIAN RESTORATION ALONG THE SACRAMENTO RIVER

F. T. Griggs, **Jessica Hammond,** River Partners, jhammond@riverpartners.org

Jessica Hammond has worked on Restoration Ecology in the Central Valley for the past seven years, working on Yellow-billed Cuckoo habitat for her Masters at CSU Chico, and as a Restoration Ecologist at River Partners Modesto office. Jessica is currently finishing her first year as a PhD student in Dr. Karen Holl's lab at UC Santa Cruz working on succession and forest dynamics of restoration on the Sacramento River.

The highly altered and managed ecological conditions present on most rivers in California have resulted in the loss of more than 95% of historic riparian forest habitats throughout the state. This has created the need for active horticultural restoration to re-build riparian habitat that supports obligate wildlife populations. It is generally accepted that riparian restoration is beneficial to wildlife populations, however the horticultural performance and successional trajectory of restored plant communities remains largely unknown. This pilot study documents observed vegetation succession following horticultural restoration on 16 sites along the Sacramento River, in two age categories (8 and 15 years following restoration). We examined plant density, species richness, vegetation structure, and community composition. Our results indicate that while stem density decreases from initial planting for both age categories, species richness does not decrease significantly. Shifts in community composition show mid and late successional species, including cottonwood and valley oak, increase in importance value from 8 to 15 year old sites, while early successional species such as coyote brush show a decrease in importance value. Results show that successional processes (recruitment and shifts in dominance) are underway at these restoration sites, although site-specific conditions are undoubtedly contributing to successional pathways. Future work of the Long-term Monitoring Program will focus on ecological and landscape variables that will provide restoration practitioners with the information necessary to target specific vegetative communities and structural features for target wildlife species.

Poster presentation

Identifying data gaps and prioritizing restoration strategies for Fremont cottonwood using linked geomorphic and population models

Elizabeth B. Harper (Paul Smiths College, Division of Forestry, Natural Resources, and Recreation), **John C. Stella** (SUNY College of Environmental Science and Forestry, Department of Environmental Science and Forestry; stella@esf.edu), Alex Fremier (University of Idaho, College of Natural Resources)

Fremont cottonwood (*Populus fremontii*) is an important component of semi-arid riparian ecosystems throughout western North America, but its populations are in decline due to land conversion and flow regulation. Balancing human resource needs and riparian ecosystem function requires a mechanistic understanding of the many geomorphic and biological factors affecting tree recruitment and survival, and modeling the system under different flow and land management regimes. We addressed these issues for the Fremont cottonwood population along the Sacramento River, CA using a global sensitivity analysis (GSA) to quantify uncertainty in parameters on the outcomes of a patch-based, dynamic population model. We defined ranges of values for 14 model parameters that represent key physical, biological and climatic components of the ecosystem and ran 2,000 Monte Carlo simulations with various parameter estimates to predict the frequency of patch colonization and total forest habitat predicted to occur long-term under the current hydrologic regime. GSA simulations yielded a wide range of predictions, including annual germination frequency of 10–100%, annual first-year survival frequency of 0–50%, and patch occupancy of 0–100%. These results indicate that Fremont cottonwood populations are highly sensitive to the interactions among flow regime, floodplain sedimentation rate and sediment texture, which controls the availability of soil moisture and interacts with biotic factors to affect survival. Understanding the spatial distribution of the physical variables would substantially improve model accuracy. Our sensitivity analyses suggest that models of future scenarios should incorporate regional climate change projections because changes in temperature and the timing and volume of precipitation affects sensitive aspects of the system, including the timing of seed release and spring snowmelt runoff.

Oral presentation

Long-term restoration of riparian understory species over large spatial scales

Holl, Karen D. (UC Santa Cruz, kholl@ucsc.edu), Hammond, Jessica E. (UCSC), Moore, Prairie L. (Natural Resources Management Corporation), McClain, Charles D. (H. T. Harvey & Associates), and Wood, David M. (CSU Chico)

Karen Holl is a professor and chair in the Environmental Studies Department at the University of California, Santa Cruz. She conducts research on restoration of tropical forests and grasslands and chaparral habitat in coastal California, in addition to her research on forest recovery on the Sacramento River.

Allocating scarce resources to restore large areas of degraded habitat requires understanding factors limiting ecosystem recovery over a range of temporal and spatial scales. We took advantage of large-scale riparian restoration efforts along the Sacramento River to compare the relative importance of within-site factors vs. the surrounding landscape on the establishment of native, understory species. We surveyed understory species composition in 15 and 35 restored forest sites along 150-km of the river in 2001 and 2007, respectively, and plan to repeat the survey in 2014. We also monitored native understory species establishment and planted and seeded seven native riparian species into a factorial experiment to test the effect of overstory cover, grass control and distance from forest edge on seedling establishment. Results of our past field surveys show that native understory species cover did not increase significantly over time and was dominated by *Galium aparine*. Both field survey and experimental results indicate that native understory cover is higher in sites with greater overstory cover which shades out non-native understory species. The effect of landscape factors varies by dispersal guild. Planting experiments showed that several understory species had higher survival when planted under an existing tree canopy. Grass herbicide treatments did not serve to reduce competition as non-native forb cover increased. Based on our results to date, we make the following management recommendations: 1. most native understory species colonize sufficiently slowly that they need to be introduced to restoration sites, particularly at locations distant from seed sources; 2. many forest species should be introduced later in success once site conditions are more favorable; and 3. establishing an overstory cover is the most effective method to control non-native understory species. We will discuss our plans for a third round of surveys in 2014 which will provide important information about long-term vegetation dynamics.

ORAL PRESENTATION:

AUTHOR: Marc Hoshovsky. FloodSAFE Environmental Stewardship and Statewide Resources Office, Department of Water Resources, 901 P Street, Sacramento, CA 95814. Hoshovsky@DWR

Marc Hoshovsky is an Office Chief in the FloodSAFE Environmental Stewardship and Statewide Resources Office at the California Department of Water Resources. His staff work on developing and implementing the Central Valley Flood System Conservation Strategy, which he will describe today. He has worked at DWR since 2009, and he previously worked for 22 years at the California Department of Fish and Widllife on statewide conservation planning.

TITLE: Central Valley Flood System Conservation Strategy

ABSTRACT: Historically, the Central Valley has experienced some of California's largest and most damaging floods. The devastating effects of floods on life and property in the Central Valley and on the state's economic prosperity inspired California's passing of the Central Valley Flood Protection Act (Act) of 2008. The Act requires the California Department of Water Resources (DWR) to develop a sustainable, integrated flood management plan – the Central Valley Flood Protection Plan (CVFPP). The Act also identifies three environmental objectives: Promote natural dynamic hydrologic and geomorphic processes, increase and improve the quantity, diversity, and connectivity of riparian, wetland, floodplain, and shaded riverine aquatic habitats, including the agricultural and ecological values of these lands, and 3) promote the recovery and stability of native species populations and overall biotic community diversity. In order to achieve these environmental objectives, DWR is developing the Central Valley Flood System Conservation Strategy (Conservation Strategy), which is a key part of the 2017 CVFPP. The Conservation Strategy provides the system-wide context and direction for DWR's environmental activities related to improving integrated flood management in the Central Valley flood management system. For the 2017 CVFPP, it provides measurable ecological objectives for ecosystem processes, habitats, and species and for planning and design objectives; it also describes the approach to attaining these objectives that includes adaptive management of implementation.

POSTER PRESENTATION

AUTHORS: John C. Hunter*[1], Kevin G. Coulton[1], Ray McDowell[2], Stacy Cepello[2], Matt Wacker[3], Lee D. von Gynz-Guethle[1], Jonathan D. McLandrich[1], and Eryn Pimentel[1]. [1]AECOM, 2020 L Street Suite 400, Sacramento, CA 95811. [2]FloodSAFE Environmental Stewardship and Statewide Resources Office, Department of Water Resources, 1416 9th Street, Sacramento, CA 95814; [3]H.T. Harvey & Associates, 711 Fourth Street, Davis, CA 95616.

CONTACT: cepello@DWR, (916) 698-5287.

TITLE: Floodplain Restoration Opportunities in the Sacramento Valley.

ABSTRACT: Floodplain restoration opportunities were analyzed to support development of the Central Valley Flood System Conservation Strategy in conjunction with the Central Valley Flood Protection Plan (CVFPP). This GIS-based analysis considered floodplain inundation potential (FIP) and other opportunities and constraints. It was conducted for 2-mile-wide corridors along the Sacramento and San Joaquin rivers and their major tributaries. Outside of urban areas, there were more than 320,000 acres of floodplain that has FIP for inundation by a 2-year event. Less than 40% of this floodplain remains hydrologically connected to the river system. Riparian and wetland vegetation covers only about a third of this connected floodplain, and the majority of this floodplain is bounded by levees whose physical condition is of higher concern. These results indicate that floodplain restoration opportunities are widespread and the potential exists to integrate restoration into the flood management actions of the CVFPP. Using this broad-scale analysis as a starting point, the focus is now on refining the constraints and opportunities for floodplain restoration on the Sacramento River and its major tributaries.

Oral presentation

Speaker: Holly R. Jorgensen (Sacramento River Watershed Program, holly@sacriver.org)
Co-author: Stephen McCord (McCord Environmental, Inc.)

Holly Jorgensen is a Watershed Management Consultant with 10 years of experience coordinating regional watershed projects and programs and is currently working with the Sacramento River Watershed Program. She holds a B.S. degree in Natural Resources Management and a B.A. in Sociology and is finishing her M.A. in Geography: Environmental Policy and Planning.

Title: A Regional Monitoring Program for the Sacramento River Watershed: Objectives, Benefits and Challenges

Abstract:
The Sacramento River Watershed Program (SRWP) is leading an effort to develop a long-term, sustainable regional monitoring program (RMP) for the Sacramento River watershed. An RMP is one way to better understand watershed conditions and track changes over time to ensure that the health of the watershed is maintained. Such an RMP would coordinate with and compliment other monitoring programs and water quality management projects both within the Sacramento River watershed and as part of the larger Bay-Delta watershed. In 2009, SRWP reported its findings of an investigation of the feasibility of developing and implementing a self-sustaining RMP for the Sacramento River watershed. The future direction and success of an RMP depends on regional support. In spite of the potential regulatory and financial incentives to participate in an RMP, there remain several significant challenges. Current efforts focus on interviewing key stakeholders to clarify their perceived benefits and challenges of participating in an RMP. This presentation will summarize the stakeholder interviews and describe the key benefits and challenges of implementing an RMP for our watershed.

Oral presentation

Dr. Eric Larsen (University of California, Davis, Department of Environmental Design, Landscape Architecture Program) and **Frank Poulsen** (ESSA Technologies, fpoulsen@ESSA.com)

Eric Larsen has been actively involved with research and planning efforts on the Sacramento River for the past two decades, including multiple research efforts for the California Department of Water Resources (CDWR), The Nature Conservancy, the U.S. Army Corps of Engineers, and many others. Dr. Larsen is currently working with CDWR's FloodSAFE Environmental Stewardship and Statewide Resources Office (FESSRO) in a comprehensive effort to make his research meander migration model available to a wide group of agencies, conservation organizations, and others who could benefit from the large-scale modeling and planning that the model makes possible.

Frank Poulsen is a Systems Ecologist at ESSA Technologies, where he is currently working on multiple California projects, including the Ecological Flows Tool, the Meander Migration Model and the Clear Creek Environmental Program. He earned his Master of Science degree in Engineering at the Technical University of Denmark, where he split his coursework between environmental and computer science.

Possible links between Bank Swallow habitat, population decline and meander migration rates, and the potential implication for management

Bank Swallows (*Riparia riparia*) are a threatened species in California that are highly dependent on geomorphological processes in the Sacramento River. Breeding pairs excavate burrows into the river bank to nest and raise young, and they depend on periodic bank renewal to avoid high levels of nest parasites and predator access due to bank sloughing. In this study, we modeled bank swallow habitat for a single colony at RM182 from 1988 to 2011 and compared it to observed number of burrows. Habitat was quantified using bank length and a weighting scheme

based on years since last bank renewal, i.e. the banks do not have to be renewed every year. Bank renewal was calculated in a GIS based on river channel centerlines generated by the Meander Migration model developed by Dr. Eric Larsen. Finally, we used Classification Tree analysis to predict number of burrows using 2 factors: weighted length of useable habitat and observed burrows the previous years. We found that habitat availability was lowest from 1988 to 1995, increased until 2000, remained high to 2009 and dropped to pre-1996 levels in 2010 and 2011. This is consistent with water year classifications, particularly from 1988 to 1995 when all but one year was dry or critically dry. The Classification Tree explains 68% of variation and predicts high number of burrows in years with high habitat availability or years following high number of burrows. This simple model supports the theory that the bank swallow population decline in some years could be related to successive dry or critically dry water years because of poor reproductive success associated with old burrows. From a management perspective, this implies that a pulse flow could be used to restore bank swallow habitat if there have been no natural bank renewal in the previous 3 years.

Oral presentation

Aric Lester and Adam Henderson (Department of Water Resources, Northern Region Office)

Aric Lester is a Senior Environmental Scientist for the Department of Water Resources' Northern Region Office in Red Bluff. Aric has worked in the area of river and floodplain restoration for much of his 15 year career with DWR. Aric has a BS in Biological Conservation from Sacramento State. For the last five years, Aric has been the project manager for the project he is going to talk to you about today. Aric enjoys working with the multiple disciplines and stakeholders that have a part in making restoration projects a success.

Title of Presentation

Applying Sacramento River Conservation Area Concepts and Our Understanding of Natural River Process in the Feasibility Study for the Kopta Slough Project

Abstract

The Kopta Slough Flood Damage Reduction and Habitat Restoration Project (Kopta Slough Project) is a multi objective project that is within the middle Sacramento River floodplain near the City of Corning and the town of Vina. The Department of Water Resources is nearing the completion of a feasibility study for the project. In the feasibility stage, we considered the benefits of the project and the uncertainty associated with the project elements. A large portion of our feasibility study relied on the assessment of biological, geomorphic, and hydrologic factors. Our assessment applied and greatly benefitted from the science and concepts that have been developed for the conservation of the Sacramento River and river restoration and management in general. These benefits are especially realized in our assessment of rock revetment removal to restore fluvial geomorphic processes. The Kopta Slough project area includes about four miles of the Sacramento River and includes restoration of riparian habitat, restoration of hydrologic and geomorphic function, restoration of habitat for listed species, reduction of flood operations and maintenance responsibilities, and providing flood management project mitigation. The Project will also serve as a pilot for actions that endeavor to restoring river function through removal of rock revetment.

Oral presentation

Ryan A. Luster (The Nature Conservancy, rluster@tnc.org) and Clint Alexander (ESSA Technologies, calexander@essa.com)

Ryan Luster is the Sacramento River Project Director for The Nature Conservancy. Ryan has worked for TNC on the Sacramento River since 2001 focusing on habitat restoration and assessing environmental flow requirements for Sacramento River dependent species.

The Ecological Flows Tool: Using ecological indicators to support resource management decisions.

The Ecological Flows Tool (EFT) is a decision support system that demonstrates how changes in flow management (and other actions) result in changes to the physical habitats for multiple species within the Sacramento River and the Delta. EFT works by integrating a range of representative functional ecological response indicators with key physical variables obtained from widely used hydrologic models. EFT transparently relates multiple attributes of the flow regime to multiple species' life-history needs, contributing to an effective understanding of flow and non-flow restoration actions on focal species and their habitats. The hallmark of the EFT approach is integration and clear communication of multiple ecological trade-offs associated with different water operation alternatives. In all, EFT includes conceptual models for eleven (11) species and twenty-four (24) causally-reasoned performance indicators. EFT performance indicators are based on a mixture of process-based ecological functions and empirical relationships between flow, habitats and focal species response. EFT's representative ecological indicators capture the essence of existing conceptual models and are driven by widely used physical models for flow, stage, salinity, and water temperature. Intuitive output interfaces allow cross-walking of ecological consequences over policy alternatives. EFT is structured as an 'ecological plug-in' to existing models that are commonly used for water planning in the Central Valley. Rather than reinventing models, EFT utilizes output data sets from daily disaggregations of CALSIM, DSM2 and other models that are used to investigate water delivery and other standards set for the CVP and SWP water system. EFT utilizes these data and adds ecological calculations to evaluate effects on multiple ecosystem targets.

Oral presentation

Matzek Virginia (Santa Clara University, Department of Environmental Studies & Sciences, vmatzek@scu.edu)

Virginia Matzek, Santa Clara University: research interests revolve around management of invasive species and restoration of ecosystems to ensure the provision of ecosystem services to humans

Carbon pools and carbon credits along a restoration chronosequence

This work, still ongoing, seeks to understand carbon and nutrient cycling in restored riparian forests, as well as the feasibility of encouraging future restoration efforts through the production of carbon credits under California's greenhouse gas accounting protocols. In summer 2012 I established a chronosequence of mixed riparian forest sites ranging in age from 0 to 21 years old and measured carbon stocks in tree, shrub, herbaceous, and forest floor biomass. Results from this study can be used to understand the trajectory of carbon accumulation on timescales comparable to the 20- to 25-year rotation common to walnut and almond orchards in the area, and evaluate the potential for income from carbon credits and conservation banking to rival farm income.

Poster presentation

McKibbin, Christian J. (California Department of Fish and Wildlife, chris.mckibbin@wildlife.ca.gov), Blandin, Krista (California Department of Fish and Wildlife) and Harry, Andrew (California Department of Fish and Wildlife).

Juvenile Salmonid Emigration Monitoring in the Sacramento River near Knights Landing

The California Department of Fish and Wildlife (DFW) Juvenile Salmonid Emigration Monitoring Program in the Sacramento River near the town of Knights Landing has been in operation for approximately 17 years. The purpose of the monitoring program is to gather information on temporal distribution, composition (race and species), and relative abundance of juvenile Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead trout (*O. mykiss*) emigrating from the upper Sacramento River to the Sacramento-San Joaquin Delta (Delta). Data gathered by the program is reported on a real time basis to water management and fisheries agencies to provide early warning of salmonids nearing the Delta. This warning allows for modifications in the operations of water transport facilities in the Delta to reduce entrainment of juveniles. Flexible water management strategies and operations lend toward protection of threatened and endangered salmonid stocks.

Poster presentation

Submitted by Scott McReynolds CA Department of Water Resources

Characterization of Habitat Flow Requirements for the Southern Distinct Population Segment (DPS) of Green Sturgeon *(Acipenser medirostris)* in the Upper Sacramento River, California

The Southern Distinct Population Segment (DPS) of green sturgeon *(Acipenser medirostris)* was listed as a threatened species by the National Marine Fisheries Service in 2006 under the Endangered Species Act. Although critical habitat for the green sturgeon covers a vast region, spawning by the Southern DPS was only known to occur in the upper Sacramento River. DWR monitoring collected eggs from the Feather River at the Afterbay Outlet in 2011 that were confirmed by UC Davis researchers as green sturgeon eggs. As part of a study led by the University California, Davis (UCD), over 125 baseline habitat units greater than five meters in depth were identified between river mile 200 near Hamilton City, California to river mile 299 at Redding, California. UCD and Department of Water Resources' (DWR) survey teams used Dual-Frequency Identification Sonar (DIDSON™) cameras to survey for sturgeon in each unit. The DIDSON™ transmits pulses of high-frequency sound waves, records the echoes returning from objects within the "field of view," and creates images from those recordings. Geo-referenced sonar images from transects in each unit were used to document locations and count adult sturgeon detected within the units. DWR selected three habitat units with frequent and consistent green sturgeon detections (aggregation sites) for additional habitat measurements. Bathymetry, velocity, and flow direction were measured in each unit with a SonTek M9 RiverSurveyor™. The M9 uses multiple acoustic frequencies to measure and provide graphical representation and tabular data of measured flow characteristics transecting the habitat units. Geo-referenced green sturgeon locations obtained with the DIDSON™ allowed us to examine the corresponding flow characteristics in which green sturgeon spawn and hold in the river. This enabled us to characterize preferred habitat that could potentially influence restoration and conservation actions designed to benefit green sturgeon.

POSTER PRESENTATION

Central Valley Flood System Conservation Strategy: Species-focused Conservation Planning.

Presenter: Ron Melcer Jr., California Dept. of Water Resources, Ron.Melcer@water.ca.gov

Authors: Ron Melcer Jr., Debra Bishop, dbishop@harveyecology.com, Sharon Kramer, skramer@harveyecology.com , Hillary White, hwhite@harveyecology.com (all H.T. Harvey and Associates).

Abstract: As a key component of the 2017 Central Valley Flood Protection Plan, the Central Valley Flood System Conservation Strategy (Conservation Strategy) is focused on achieving the environmental objectives of the Central Valley Flood Protection Act of 2008 through refining the approaches described in the 2012 Central Valley Flood Protection Plan. The Conservation Strategy includes developing specific conservation plans for 17 State or federally listed Threatened and Endangered species which are both dependent on the riverine ecosystems within the Central Valley and associated with the flood management system. These plans will summarize life history information and conceptual models of key habitats, ecosystem processes and stressors, as well as identify specific conservation needs of these imperiled taxa relevant to the flood management system. The plans will inform the development of multi-purpose flood management projects, improve operations and maintenance practices for the State Plan of Flood Control, and support the conservation planning, permitting, and mitigation elements of the Conservation Strategy.

ORAL PRESENTATION (or poster presentation)

AUTHORS: Melcer Jr., Ron (California Department of Water Resources, Ron.Melcer@water.ca.gov, Henderson, Adam (California Department of Water Resources, Adam.Henderson@water.ca.gov)

Ron Melcer is a staff environmental scientist at the Department of Water Resources, and is currently working on the Central Valley Flood System Conservation Strategy, and important component of the Central Valley Flood Protection Plan.

TITLE: Bank Swallow Response to Rock Revetment Removal on the Sacramento River, California.

ABSTRACT: The meandering portions of the Sacramento River between Keswick Dam and Colusa, California provide the most significant breeding habitat resource to more than 70% of California's State Threatened Bank Swallow (*Riparia riparia*) population. Throughout this reach, river bank stabilization efforts have degraded and reduced the amount of suitable eroding banks, and Bank Swallow use of the river corridor has been in decline. The Bank Swallow Recovery Plan, many scientific papers, and, recent modeling efforts have suggested that removal of rock revetment along the Sacramento River would contribute to the persistence and recovery of Bank Swallows, however, the large-scale efficacy of this activity in benefiting Bank Swallows is untested. Using historical aerial photography, rock revetment datasets, and Bank Swallow colony survey data, we evaluated Bank Swallow response at locations where revetment along the Sacramento River from Colusa to Redding was removed through high water events, or is no longer serving its design purpose on the river bank. We found 9 instances where rock revetment no longer remained in place, and at all locations, Bank Swallow colonies were re-established. Locations were located on the 100 year meanderbelt, where rock revetment had been placed on alluvium. At 7 of 9 locations, colonies were re-established within 1-2 years, and in 2 cases, Bank Swallows returned after nearly 10 years. Given the nearly universal response throughout the study area, we find this compelling empirical evidence that removing rock revetment will provide an increase in useable habitat, and has the potential to contribute to the persistence and recovery of the species.

Poster presentation

Bruce K. Orr (Stillwater Sciences, bruce@stillwatersci.com), Clifford S. Riebe (University of Wyoming, Laramie) and Ryan Peek (University of San Francisco).

Linking biological responses to river processes: Implications for conservation and management of the Sacramento River—a focal species approach

The loss and degradation of essential habitats in the Sacramento River corridor has generally reduced the river's capacity to support native species. The processes, habitats, and species of the Sacramento River have been the focus of much study, and the volume of available reports and datasets poses a challenge for synthesizing information and organizing a discussion of ecosystem components. Divergent conceptual models about process–habitat–biotic linkages complicate the process of summarizing what is known about the Sacramento River, and add to the challenge of evaluating alternative approaches for conserving and restoring the river ecosystem. To help overcome these challenges, our study discusses and analyzes the Sacramento River through the lens of six focal species. A focal species approach facilitates the exploration of linkages among ecosystem processes, resultant habitats, and biotic needs. For each focal species, we identify the different life history stages that occur in the Sacramento River, the habitats used by each of those life history stages, the ecological processes that create and maintain those habitats, and the management actions (e.g., changes in the flow regime or bank revetment) that influence those ecological processes and habitat conditions. The six focal species selected for this study are Chinook salmon (*Oncorhynchus tshawytscha*), steelhead (*O. mykiss*), green sturgeon (*Acipenser medirostros*), bank swallow (*Riparia riparia*), western pond turtle (*Clemmys marmorata*), and Fremont cottonwood (*Populus fremontii*). Because fish species have generally received more attention, our poster will focus on the three non-fish focal species. We will summarize key findings and hypotheses regarding (i) the effects of land use and water supply development on the broader ecosystem, and (ii) the key resource management challenges in the Sacramento River system using the focal species as a framework. This study was undertaken as part of the Sacramento River Ecological Flows Study, which was initiated by The Nature Conservancy (TNC) in collaboration with ESSA Technologies, Stillwater Sciences, UC Davis, and UC Berkeley.

Poster presentation

Padgett Evan W. (California State University Chico, Department of Biological Sciences, epadgett1@mail.csuchico.edu), Schierenbeck Kristina A. (California State University Chico, Department of Biological Sciences)

Historical and contemporary gene flow between a cultivated hybrid and native *Platanus* species along the northern Sacramento River, California

Hybridization can be a primary source of gene flow between sympatric species and empirically measured rates of allele frequencies in different demographic groups can be used to model the temporal dynamics of gene flow. Introgressive hybridization among historically allopatric, anemophilous populations can contribute to changes in allele frequency within the respective species. The future direction and extent of allelic frequency change through time by introgressive hybridization however, remains largely unknown especially among native and non-native taxa. Historic habitat loss for the native *Platanus racemosa* (Western Sycamore) in northern California riparian woodlands coupled with recent, increased plantings of the non-native, introduced hybrid *Platanus* × *hispanica* (London Plane) have been hypothesized to result in native allelic frequency replacement through introgressive hybridization. Within the northern California native range of the *P. racemosa*, seven hundred individual *Platanus spp*. trees in 23 locations have been sampled for diameter breast height (dbh), mapped via GPS, and had their DNA extracted. Eleven previously established, species-specific genomic microsatellite DNA markers will be used to genotype each tree sampled and dbh measurements will be used as a surrogate for age. The genetic identities of native, introduced, and hybrid populations will be quantified using STRUCTURE, and rates of allelic replacement over time will be estimated for the native *P. racemosa* lineage. This work will identify unhybridized native *P. racemosa* individuals that will be used for future revegetation efforts. The genetic identity (native, introduced, hybrid) and gene flow data will provide empirical data for landscape level models used to predict the consequences of genetic pollution from introduced, conspecific taxa. The significance and extent of the proposed population genetic study of introgressive hybridization will elucidate the impacts that human activities can have on evolutionary processes at the urban-wildlife interface.

Oral Presentation

***William Poytress**, US Fish and Wildlife Service: Red Bluff Fish and Wildlife Office*
Richard Corwin (retired), US Bureau of Reclamation
Michael Thomas, UC Davis, Department of Wildlife, Fish & Conservation Biology

Bill Poytress has worked on juvenile salmonid monitoring and green sturgeon life history research projects within the Central Valley for nearly 15 years. He is currently a Fish Biologist and Project Manager with the U.S. Fish and Wildlife Service in Red Bluff, CA and the chair of the Central Valley Salmonid Juvenile Monitoring Project Work Team.

North American Green Sturgeon (*Acipenser* medirostris) Impact Mitigation Measures in the Upper Sacramento River, California

Between 2008 and 2012 a multi-entity collaborative research effort documented multiple life history characteristics of the Federally listed as Threatened, Southern Distinct Population Segment of the North American green sturgeon (*Acipenser medirostris*) in the Sacramento River, California. Through tagging and tracking of adults, egg sampling, and juvenile migration data collection, impacts of water resource management activities to green sturgeon could be evaluated. Due in part to the data collected, the Red Bluff Diversion Dam and its operations were determined to result in a jeopardy decision of the Central Valley Project water resource operations in this area. Augmentation of operations and ultimately, replacement of the diversion dam with a high capacity water pumping plant were considered to be sufficient to reduce the impacts of these water diversions to acceptable levels. Additional mitigation measures in the highly regulated Sacramento River should be evaluated by water resource managers, in terms of temperature and discharge levels and timing, to take into consideration two sturgeon species in addition to the current operations focusing on threatened and endangered salmonids.

Poster Presentation

Rogers, Matt (CSU Chico mrogers8@mail.csuchico.edu)

Utilizing a species distribution model to identify potential habitat for the yellow-billed cuckoo along the Sacramento River

Though the yellow-billed cuckoo has a broad geographic distribution in the U.S. it has a limited distribution in the western U.S. and is an endangered species in California. With the potential federal listing of this species, it is important to understand the current range of this species within California and identify breeding sites, taking both vegetation characteristics and various environmental factors into consideration. Along the Sacramento River, surveys indicate site use appears to be dynamic, with a very small number of areas being used year to year. The Sacramento River population also appears to have declined precipitously in the last 5-10 years, which is troubling given the amount of available habitat and the efforts to restore riparian habitat specifically for cuckoos. Using a combination of survey detections for yellow-billed cuckoos within the last 5 years and Maxent, a habitat modeling program, potential species distribution maps were created for the Sacramento River which could provide insight into suitable yellow-billed cuckoo habitat distribution, as well as to refine survey efforts to concentrate on all suitable habitat within the region.

This presentation will be a talk.

***Rogner Michael**, and Griggs F.T.* River Partners. 580 Vallombrosa Avenue, Chico, CA.
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Michael Rogner has worked on the middle Sacramento River for more than 10 years, and currently designs and implements large scale riparian restoration projects for River Partners.

Tipping the balance: Using natives to combat weeds and promote ecological resilience of riparian restoration

The construction of dams and levees throughout the Central Valley has altered ecological conditions on its floodplains so that they do not favor the establishment of native woody or herbaceous species. Dams and levees have altered the natural hydrology and geomorphology to which native riparian vegetation is adapted. Because of these alterations and other disturbances, native vegetation is frequently outcompeted by aggressive invasive weeds. Restoration projects implemented on the Sacramento River have established approximately 8,000 acres, to date, of riparian forests with native woody species. Frequently, however the herbaceous understory layer is dominated by annual grasses or other weeds.

Large scale restoration projects undertaken by River Partners have been designed to increase overall biodiversity and habitat structure for wildlife usage. Our goal is also to combat the establishment of non-native invasive species. These objectives have been achieved through an aggressive approach of understory weed management and the establishment of an herbaceous layer consisting of perennial natives. Through experimentation, River Partners has been successful at germinating and establishing several native grass species, as well as broadleaved species such as *Artemisia douglasiana*, *Grindelia comporum*, *Heterotheca grandifoli*, and *Euthamia occidentalis*, to name a few. We use an approach which combines modern agricultural equipment and techniques along with up-to-date scientific knowledge and adaptive management practices.

For these projects to be successful, they must be resilient to foreseeable future disturbances. Our projects have undergone a number of disturbances included unnatural flooding (timing and duration) and fire. Monitoring shows that post disturbance understory has 71% absolute native cover two years following disturbance. Long term monitoring is necessary to determine how native herbaceous species will continue to react to ecological conditions.

POSTER PRESENTATION

AUTHORS: Schwenkler, Jason; Carlson, Melinda; Kreb, Brian; Askim Laura (Geographic Information Center – CSU Chico)

TITLE: Medium-scale Vegetation Mapping of the Central Valley of California

ABSTRACT: Landscape-scale vegetation mapping provides an understanding of the spatial structure of and distribution of vegetation across a landscape. It also provides a baseline condition useful in the future evaluation of changes in these metrics. In an effort to better inform the development and implementation of the Central Valley Flood Protection Plan and Central Valley Flood System Conservation Strategy, wetland and vegetation types from Keswick Dam near Redding, California to the Kings River in the Tulare Basin were mapped using the National Vegetation Classification System (NVCS) Group Level with provisional NVCS groups as presented by Sawyer et al. (2009), at a minimum mapping unit of 1.0 acres. Prior to the creation of this map, no riparian vegetation map had been made at this scale to quantify vegetation of the Great Valley. This map documents existing conditions for the vegetation present in the Great Valley during 2009, and using geographic information systems (GIS) can be overlaid with other data sets such as soils, hydrology, sensitive species, for future modeling. The map has been incorporated in strategic planning efforts related to flood control, mitigation, habitat conservation, and invasive species control. Currently, the medium scale map is being re-mapped at the “alliance level” (fine-scale), and providing both a higher level of resolution and information on vertical structure and density. Future mapping could entail mapping to the association level, mapping areas that are outside the current map boundary, and revisiting the same level of mapping in future years to compare trends and changes.

Oral presentation

Seavy Nathaniel E. (PRBO Conservation Science, nseavy@prbo.org), Cormier Renée (PRBO Conservation Science), Hammond Jessica (UC Santa Cruz), Silveira Joe (Sacramento River National Widlife Refuge), and Golet Greg (The Nature Conservancy)

Nat Seavy is the Research Director of the Pacific Coast and Central Valley Group at PRBO Conservation Science. Nat received a bachelor of science from The Evergreen State College, and a Ph.D. from the Department of Zoology at the University of Florida. Much of Nat's current work is focused on the ecology and conservation of riparian ecosystems, bird migration, and climate change adaptation.

Effects of vegetation structure and grazing on wintering bird communities of the Sacramento River floodplains

In February of 2013, we surveyed vegetation and wintering landbirds on the floodplains of the Sacramento River National Wildlife Refuge in the Central Valley of California. We located a total of 25 plots on the La Barranca, Capay, and Sul Norte units. Vegetation types on these units included perennial grassland, riparian savannah, and riparian forest and plots were located to capture grazed and ungrazed areas of each vegetation type. The grazing program on these units was designed to improve wildlife habitat structure and native summer forb germination conditions, reduce non-native annual plant thatch buildup, and reducing forest ladder fuels. Plots were 150 x 150 m and were located systematically in either grazed or ungrazed areas in such a way that they fell within a single vegetation type. At each plot we conducted area search surveys of the wintering bird community and transect surveys of vegetation structure and composition. To summarize the structural variation in vegetation, we conducted a principal components analysis of the percent cover of grasses, shrubs, and trees. The first principal component captured 65% of the variation in these variables and clearly described a gradient from open grasslands to savannah to riparian forest. The abundance of three wintering bird guilds (grassland-, shrub-, and forest-associates) varied predictably across this gradient. This variation provides management guidelines that can be used to inform restoration designs for each guild. After controlling for differences in abundance associated with the major

habitat gradient, there was no strong evidence that the abundance of birds from these three guilds differed between grazed and ungrazed plots.

Poster presentation

Seesholtz, Alicia M. (Department of Water Resources, Alicia.Seesholtz@water.ca.gov) and Chase, Robert D. (US Bureau of Reclamation)

Sacramento green sturgeon and their highly migratory lifestyle: implications for management and restoration

The Southern Distinct Population Segment (sDPS) of North American green sturgeon (green sturgeon) was listed as threatened on April 7th, 2009. The majority of sDPS green sturgeon spawn in the Sacramento River. Mature adults return to the spawning grounds every two to five years. The adults may enter the Sacramento River as early as February and may stay until the following February. However, green sturgeon are the most highly migratory of the sturgeon species and will utilize estuaries and bays along the West Coast when they are not on the spawning grounds. Our objective is to understand the adult lifestage of this species and the factors affecting it in order to make appropriate management and restoration decisions that could benefit the species for delisting. As such, acoustically tagged Sacramento green sturgeon were tracked and recorded after they emigrated from the river using a series of VEMCO arrays that are deployed within the Central Valley and along the West Coast of North America from California to Alaska. Sacramento green sturgeon were detected as far north as the mouth of Grays Harbor, Washington. We are beginning to gather information that can help determine where management and restoration activities may have the greatest benefit to adult sDPS green sturgeon whether this is in the Sacramento River, the Bay-Delta, or along the West Coast migration pathways, bays, or estuaries.

Poster presentation

Silveira Joe (USFWS, Sacramento National Wildlife Refuge Complex, joe_silveira@fws.gov), Golet Greg (The Nature Conservancy, Chico), Garcia Dawn (California State University, Chico), Isola Jennifer (USFWS, Sacramento National Wildlife Refuge Complex), Carpenter Mike (USFWS, Sacramento National Wildlife Refuge Complex), Wolder Mike (USFWS, Sacramento National Wildlife Refuge Complex), Henderson Adam (California Department of Water Resources, Northern Region Office and FESSRO), Tsao Danika (California Department of Water Resources, Environmental Services), Schlorff Ron (California Department of Fish and Wildlife, retired)

Joe is a Wildlife Biologist with the US Fish & Wildlife Service stationed at Sacramento National Wildlife Refuge Complex since 1992 where he has primary responsibilities for biological programs at Sacramento River National Wildlife Refuge and Llano Seco. He works on restoration and management programs which includes riparian and floodplain habitats, managed wetlands, vernal pool, alkali meadow, and grassland habitats. This work involves developing many fruitful partnerships for habitat restoration, monitoring and research.

"Bank Swallow (*Riparia riparia*) Colony Population Status and Trends on the Middle Sacramento River-- 1999 to 2012"

Surveys for the Bank Swallow (*Riparia riparia*) along the middle Sacramento River from Red Bluff (RM 243) to Colusa (RM 143) have been conducted nearly annually from 1986 to present. Surveys from 1999 onward were done using standardized periods and GPS with data error-proofed and entered into a geospatial database (Garcia 2009). Results show that while the number of active burrows in 2012 was only 9% below the 1999 count, the most recent three-year mean is 31% lower than the first three-year mean (Table 1) and indicative of a pronounced declining trend (Figure 1). The cause for decline is likely the continued loss in nesting habitat due to increases in bank revetment. From 1936 to 2012, over 50 miles of agency rock and private rubble were dumped on the banks of the Sacramento River between Red Bluff and Colusa (Figure 2). Since then, additional colony locations have been lost to both agency and private bank revetment. If these population and habitat trends continue, Bank Swallow will likely become extirpated on the Sacramento River. Girvetz (2010) found that the total available area of suitable habitat seemed to drive Bank Swallow population trends and that restoration of riverbank habitat (removal of riprap) reduced extinction probability to less than 10%. This is a 57% reduction in the probability of the population dropping below the quasi-extinction threshold compared to the current condition (Golet and others 2013). The recently completed Bank Swallow Conservation Strategy specifies the amount and type of habitat restoration (rip-rap removal and riparian and floodplain vegetation restoration) needed to recover and maintain the species on the middle Sacramento River, its tributaries and elsewhere in California (Bank Swallow Technical Advisory Committee 2013).

Oral presentation

Silveira Joe (USFW, Sacramento National Wildlife Refuge Complex, joe_silveira@fws.gov) and Moroney Kelly (USFWS, Sacramento National Wildlife Refuge Complex
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Sacramento River National Wildlife Refuge Comprehensive Conservation Plan– Implementing Objectives for the Wildlife and Habitat Goal

Sacramento River National Wildlife Refuge was established in 1989 and authorized to acquire 18,000 acres on the 100-year floodplain between Red Bluff and Colusa. It was established to conserve endangered and threatened species and their habitats. In 1989 these included Least Bell's Vireo, American Bald Eagle, Sacramento River winter-run Chinook salmon, and Valley elderberry longhorn beetle. Other refuge purposes were to provide riparian and floodplain habitats for migratory bird conservation, and to manage for native fish, wildlife, plants. Currently, Sacramento River National Wildlife Refuge consists of 29 units totaling 10,235 acres scattered along 77 miles of the Sacramento River. The Sacramento River National Wildlife Refuge Comprehensive Conservation Plan was completed in 2005. This 15-year management plan established various goals for Refuge Management Programs. The Wildlife and Habitat Goal is to contribute to the recovery of endangered and threatened species and provide a natural diversity and abundance of migratory birds and anadromous fish through the restoration and management of riparian habitats along the Sacramento River. To do this, 10 objectives were established: riparian vegetation and habitat; floodplain and river processes; threatened and endangered species; migratory and resident landbirds; waterfowl and other waterbirds; anadromous and native fisheries; native plant species; exotic, invasive species control; and, wildlife and cultural resources sanctuary. Multiple strategies were identified for each of these objectives. Many of these have been implemented through numerous dedicated partnerships. Examples include restoring 5,279 acres of floodplain vegetation, treating 4,090 acres for invasive species control (2013 alone); reconnecting the floodplain with the main channel through the removal or breaching of three privately installed levees; restoring habitat for the Valley

elderberry longhorn beetle by planting 114,420 elderberry plants; and, conducting research to determine presence of Valley elderberry longhorn beetle and Yellow-billed Cuckoo at restored sites. Since 1992, over 80 monitoring surveys and research investigation have been conducted at Sacramento River National Wildlife Refuge. They cover a range of abiotic and biotic targets. Restoration success has been demonstrated by increased diversity of invertebrate and vertebrate taxa. More work remains to fully recover listed species and to provide optimal habitat for native fish and migratory birds.

Oral presentation

Coevolving floodplain and riparian forest dynamics on the Middle Sacramento River, CA

John C. Stella and Jess Riddle (SUNY College of Environmental Science and Forestry, Department of Environmental Science and Forestry; stella@esf.edu), John J. Battles (University of California, Berkeley, Department of Environmental Science, Policy and Management)

John Stella is field ecologist and Associate Professor of Forest and Natural Resources Management at State University of New York College of Environmental Science and Forestry (SUNY-ESF). His research interests focus on riparian and stream ecology, dendroecology, plant ecohydrology and stable isotope biogeochemistry, and restoration ecology. He earned his Ph.D. at UC Berkeley and his research sites are located in semi-arid regions of California and the U.S. Southwest, Mediterranean Europe, and the Adirondack mountains of New York.

On large meandering rivers, riparian forests coevolve with the floodplains that support them. Floodplain characteristics such as local disturbance regime, deposition rates and sediment texture drive plant community dynamics, which in turn feed back to the abiotic processes. We investigated floodplain and riparian forest coevolution along the along the Sacramento River (California, USA), a large, mediterranean-climate river that has been extensively regulated for 70 years, but whose 160–km middle reach (Red Bluff to Colusa) retains some channel mobility and natural forest stands. Guided by maps of floodplain change over time and current vegetation cover, we conducted an extensive forest inventory and chronosequence analysis to quantify how abiotic conditions and forest structural characteristics such as tree density, basal area and biomass vary with floodplain age. We inventoried 431 fixed-area plots distributed across 19 large point bars within vegetation patches ranging in age from 4 to 107 years. Two successional trajectories were evident: (1) shifting species dominance over time within forested areas, from willow to cottonwood to walnut, boxelder and valley oak; and (2) patches of shrub willow (primarily *Salix exigua*) that maintained dominance throughout time. Sediment accretion was reduced in the persistent willow plots compared to the successional forest stands, suggesting an association between higher flood energy and arrested succession. Forested stands 40-60 years old were the most extensive across the chronosequence in terms of floodplain area, and supported the highest biomass, species diversity, and functional wildlife habitat. These

stands were dominated by Fremont cottonwood (*Populus fremontii*) and reached their maxima in terms of tree size and biomass at age 50 years. The persistent willow stands supported lower biomass and did not shift in composition or structural characteristics over time. These results indicate that river migration and sediment dynamics are integrally tied to the development of multi-aged forest structure, especially ecologically important middle-aged stands.

Oral presentation.

Swagerty, Helen L. (River Partners, hswagerty@riverpartners.org), Tom Griggs, and Michael Rogner

Helen Swagerty received a B.S. in Environmental Science with an emphasis in environmental geosciences from Oregon State University. As a biologist with River Partners since 2000, she has experience in the various phases of restoration-planning, implementation, monitoring and reporting. Her primary responsibilities are to manage complex, interdisciplinary projects aimed at seeking a balance between environmental benefits and societal needs.

Riparian Sanctuary: Using Multiple Science Disciplines to Design Grass Roots Solution for Agricultural and Environmental Interests

Agencies are moving toward multi-benefit projects. These projects aim to address multiple objectives such as flood attenuation and transitory storage, reduction in flood risk, enhancement of wildlife habitat, and the support of ecosystem services and natural river processes. However, navigating within the different systems of governance complicates the ability to bring partnerships together. A paradigm shift is required to integrate flood and natural resource management, and this strategy needs to balance provisions for flood control project operation and maintenance while protecting and enhancing ecosystem values and function.

River meander threatens the operation of the $11 million Princeton-Codora-Glenn and Provident Irrigation Districts (PCGID-PID) pumping plant that supplies irrigation to 30,000 acres in Glenn and Colusa Counties. As the opposing bank retreats along the boundary of the US Fish and Wildlife Service (USFWS) Sacramento River National Wildlife Refuge's Riparian Sanctuary Unit (Sacramento River Mile 178), it modifies the angle of approach of the water flowing past the fish screens at the pumping plant. Flows become more direct and may trap fish against the

screen. However, the Riparian Sanctuary Project, a joint effort between the USFWS and PCGID-PID, demonstrates a process of finding sustainable solutions to protect the pumping plant, while restoring 500 acres of riparian habitat and contributing to species recovery.

The process is rooted in a multi-disciplinary investigation that includes hydraulic modeling, river meander analysis and habitat restoration design, which considers bank stabilization, restoring natural river processes, and maintaining the flow split between the Sacramento River and the Butte Basin Overflow Area. The strategy has been to synthesize and to disseminate the results from technical investigations to garner support from stakeholders, educate flood managers and policy makers and to negotiate project design elements with regulatory agencies. Once implemented, the project will result in 2,200 linear feet of unneeded revetment taken out of the system, improved river processes, 400 acres of new riparian habitat, and the bank protection needed to deliver water to 30,000 acres of farmland.

Poster Presentation

Whittaker Abigail R. (California State University Chico, Department of Geological and Environmental Sciences, abigail.r.whittaker@gmail.com), Hatfield Colleen, Ph.D (California State University Chico, Department of Biological Sciences), Derugin Vasilissa, MS (San Francisco State University, Department of Biology)

Managing for the Future: Analyzing the Effects of Structural Landscape Composition on Animal Visitation in the Sacramento River Corridor

For 25 years, systematic land acquisition and restoration has been undertaken along the Sacramento River in an effort to recreate the formerly dynamic floodplain and minimize property loss during flood events. However, the ability of restored riverine forest to support a complex trophic web, including mega-predators, is little understood. To examine how restoration influences landscape structure and, in turn, animal visitation, several dimensions of this changing landscape were characterized using geospatial analysis and then related to animal sightings over two years (Derugin, 2013). Five infrared game cameras were mounted in each of three riparian forest age classes: young restored (<10 years old), old restored (>10 years old)

and remnant. Sites were selected for consistency of understory structure and canopy within each treatment. Camera location coordinates were imported to ArcGIS 10.0 and buffered at two radii: 0.25 and 0.50 miles. These circular footprints were overlaid on geospatial layers containing data on restoration sites and land cover for the Sacramento River vicinity. Four parameters were analyzed within each of the two radii: proportion of agricultural land, proportion of restored land, edge complexity (perimeter-to-area ratio) and patch diversity (Shannon Diversity Index). In stepwise regression of the 0.25 and 0.50 mile buffer data, the visitation rate of mega-predators was predominantly explained by edge complexity. Perimeter-to-area ratio was significantly higher in remnant than young restored sites, and mega-predator occurrence was significantly higher in young forest. When all species observed were considered, patch diversity best accounted for the rate of visits in the 0.25 mile buffer. Better understanding animal response to structural landscape composition can inform restoration design and long-term management to reconnect the Sacramento River wildlife corridor.

Closing remarks:

Dawit Zeleke, Director of the Great Central Valley and Mountains Region, oversees the Conservancy's work in the Central Valley, Klamath, and Sierra Nevada ecoregions. He has more than 20 years of experience in agriculture, habitat management, and habitat restoration. Before he assumed his present position in December 2005, Mr. Zeleke was director of the Sacramento River Project from 2002 to 2005. From 1998 to 2002, he held the position of agriculture and restoration program manager for the Sacramento River Project. He joined the Conservancy in 1992 as restoration manager and assistant preserve manager for the Cosumnes River Preserve. Before that, he was a small-scale organic produce farmer in Yolo County, and he still owns and operates an organic mandarin orchard in Glenn County. He was awarded a two-year California Agricultural Leadership Program fellowship in 1997. He holds a B.A. in anthropology from Friends World College in Huntington, New York.