Session 4: Vegetation and Riparian Ecology

Modeling interactions of flow and vegetation for improved riverine system management
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The establishment, growth, and decline of riparian vegetation within impacted riverine systems is a growing challenge due to the increasing priority of maintaining ecosystem function while sustaining water supply and providing flood protection. A quantitative two-dimensional model is presented for predicting the interactions between flow and vegetation that is currently under development at BOR. The model is based upon the SRH-2D package, which contains a two-dimensional flow and mobile bed sediment transport model. The new SRH-2DV package incorporates a module that simulates the effect of vegetation on river and floodplain hydraulics through spatially distributed roughness. The coupled vegetation-hydraulic solver uses measured vegetation parameters to calculate a spatially-distributed, dynamic Manning's roughness coefficient while simulating the hydrodynamics of the system. Field and modeling work focused on a reach of the San Joaquin River near Fresno, California. Simulation results using the vegetation module are compared with measured water surface elevation and results from a manually-calibrated SRH-2D hydraulics model. We present initial simulation results from application to simple case studies and discuss the utility of expanding the predictive capabilities to include comprehensive lifecycle processes. Results from SRH-2DV will aid the science, economics, and policy of establishing environmental flows by addressing questions regarding the physical interaction of flow and vegetation in rivers and floodplains.

Riparian vegetation mapping and landscape-scale mitigation planning on the San Joaquin River
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The Riparian Habitat Mitigation and Monitoring Plan (Plan) was developed to fulfill and present a framework for implementing one of the San Joaquin River Restoration Program's (SJRRP) Program Environmental Impact Statement/Report (PEIS/R) Conservation Strategy measures related to Riparian Habitat and Other Sensitive Natural Communities (RHSNC), RHSNC-2(a). Per Conservation Strategy measure RHSNC-2(a), riparian habitat (also referred to as riparian vegetation) that establishes under the SJRRP will be used as credit to compensate for project-specific impacts to riparian habitat. This accounting of naturally recruited and established vegetation types will be done before determining if any additional compensatory measures are required. The Plan presents a process for identifying and monitoring the riparian habitat that establishes and is enhanced by SJRRP actions, such as Interim and Restoration Flows, restoration/conveyance projects, and land use changes, as compensation credits, alongside project-specific impacts, to ensure and demonstrate that there is no net loss of riparian habitat as a result of implementing the SJRRP. (The term "credit", as used in the Plan, does not indicate any particular legal meaning or that such credits would be bought, sold, or otherwise managed as a mitigation or conservation bank.)

Mapping of riparian vegetation performed a number of vital roles during the development of the Plan. Riparian vegetation in the 150-mile restoration area (Restoration Area) was mapped to the group and, to the extent possible, alliance levels using *A Manual of California Vegetation* (Sawyer et al. 2009) classification system. The resulting map was then used to: (1) detect longitudinal patterns in native and nonnative vegetation types; (2) estimate, in conjunction with a riparian vegetation recruitment model, whether natural vegetation recruitment predicted under restoration flows would result in riparian habitat creation or enhancement; and (3) identify high priority areas to evaluate for riparian vegetation credits. The field assessment phase of the vegetation mapping was expanded to allow for evaluation of natural vegetation recruitment and was used to identify where riparian vegetation credits may already be available. The use of California standards for mapping and vegetation classification allowed for integration with another recently developed vegetation map of the region. Ultimately, the vegetation map proved to be an important tool to understand riparian resources in the Restoration Area, identify and monitor appropriate compensation areas for impacts to riparian vegetation, and implement a landscape-scale approach to riparian habitat management in the face of natural disturbance, human disturbance, and climate change uncertainties.

This presentation will introduce the audience to the essential elements of the Plan as a potential regulatory compliance tool and describe the methods used to establish the Plan's technical foundation.

Multi-benefit weed control: the San Joaquin River invasive species management and jobs
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The San Joaquin River Restoration Program (SJRRP) funded the San Joaquin River Invasive Species Management and Jobs Creation Project in order to manage and monitor invasive species along the 150-mile stretch slated for higher river flows, and to provide jobs for area residents in a region of chronically high unemployment. River Partners and the San Joaquin River Parkway and Conservation Trust (SJRPCT) have divided the conservation reaches (River Partners reaches 4 and 5, SJRPCT Reaches 1-3) to tackle this large-scale project. Initial project phases focused on planning, permitting, and negotiations with landowners for site access. Mapping of invasive species began in 2011, and >5000 acres of the SJRRP Program Area have been mapped to date including the San Luis and Merced NWRs, Great Valley Grasslands State Park, Hatfield State Recreation Area, Riverbottom Park, Scout Island, Sycamore Island, Spano River West, Van Buren Unit and five private inholdings along the San Joaquin River. Focal invasives have included giant reed (*Arundo donax*), red sesbania (*Sesbania punicea*), salt cedar (Tamarix sp.), perennial pepperweed (Lepidium latifolium), edible fig (*Ficus carica*), Himalayan blackberry (*Rubus armeniacus*), yellow starthistle (*Centaurea solstitialis*), and tree tobacco (*Nicotiana glauca*). Using the baseline spatial data collected in the initial year and compiled data from partners, we have balanced multiple factors to prioritize treatment of invasive species. Treatments began in 2012 and 2013 and have continued through 2014 and 2015. Mechanical, chemical and grazing methodologies employed to date have been developed through experience, research, and additional consultation. In partnership with university researchers, additional techniques (e.g., solarization) are also being evaluated for invasive control. Over 500 acres of invasives have been treated, including >400 acres of *L. latifolium*, 160 acres of *S. punicea*, 15 acres of *A. donax*, and smaller extents of other species. Treatment effectiveness is being assessed via field monitoring in Spring 2015. We have also begun broadcasting seed of competitive native grasses in areas treated with broadleaf-selective herbicide to prevent invasive recolonization. In addition to funding permanent restoration staff and seasonal interns, the project has provided temporary positions for over 50 California Conservation Corpsmembers, over 230 Fresno Local Conservation Corpsmembers, and 60 agriculture labor crewmembers, all of whom have received job training related to riparian restoration and invasive species control. In addition, outreach activities have included presentations, publications, newspaper articles, and meetings with landowners and managers.

Meeting multi-benefit project goals in river restoration – a case study from the San Joaquin River National Wildlife Refuge
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In 1997, massive flooding along the San Joaquin River encouraged three landowners to sell their flood-prone farmlands to the US Fish and Wildlife Service for inclusion in a Non-Structural Alternative Flood Management Project. The US Army Corps of Engineers, USFWS, and Central Valley Flood Protection Board developed a plan for a multi-benefit flood protection and wildlife habitat restoration project that would come to be known as the Three Amigos project. In partnership with the USDA Natural Resources Conservation Service, the lands were purchased for inclusion in the San Joaquin River National Wildlife Refuge for improved regional flood management and wildlife habitat restoration. River Partners began working with the USFWS in 2001 to design and implement habitat restoration. ESA PWA was hired in 2001, 2004, and again in 2013 to perform hydraulic modeling to assist the stakeholders in identifying the best configuration for levee breaches and other flow management structures to optimize both wildlife values for the 3,000-acre floodplain and transient floodwater storage opportunities to reduce peak flood stage regionally. Since the initiation of restoration, the project has hosted a successful reintroduction site for federally endangered riparian brush rabbits, and has hosted significant recovery milestones for other special-status species including Least Bell's Vireo, Yellow Warbler, Valley Elderberry Longhorn Beetle, and San Joaquin woodrat. Over $40 million has been invested by more than 15 funding agencies and programs to support this collaborative effort. In 2014, the final phase of habitat restoration was completed under a grant from the California Department of Water Resources. In 2015, the final action of levee modification will be undertaken to provide

hundreds of acres of river-floodplain connectivity during relatively frequent flood events, while preserving the ability to develop optimal peak flood attenuation benefits in the future. The habitat restoration, species recovery, and hydraulic modeling performed for this project is a model in multi-benefit project management, including active engagement from dozens of conservation organizations, the Endangered Species Recovery Program at CSU Stanislaus, Point Blue Conservation Science, Ducks Unlimited, many state and federal agencies, local governments, community groups, farmers, engineers and regulators.

Measuring restoration success: applying the Central Valley Joint Venture population objectives for riparian birds
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River and riparian restoration projects provide multiple benefits to the fish, wildlife, and people that depend on them. Thus, multiple metrics of success may better capture the full value of these restoration projects beyond their direct impacts on fish populations. For example, bird populations are excellent indicators of riparian ecosystem condition, reflecting a broad range of ecosystem functions and responding quickly to restoration. Further, the recently revised Central Valley Joint Venture riparian bird population objectives provide an easy way to measure the success of individual restoration projects. These population objectives are intended to achieve a long-term goal of healthy riparian ecosystems in the Central Valley that are capable of supporting robust and resilient wildlife populations, benefitting people and wildlife of the Central Valley and beyond. Monitoring bird populations before, during, and after restoration project implementation is a simple way to measure the actual contribution of the project toward achieving these long-term goals, and ultimately to demonstrate project success. To illustrate these concepts, we conducted an analysis of the 2,100-acre Dos Rios Ranch restoration projected located at the confluence of the San Joaquin and Tuolumne rivers in the San Joaquin Valley. One of the largest restoration projects in the Central Valley region, Dos Rios Ranch is being restored by River Partners with funding from numerous state and federal partners and collaborative support from the Tuolumne River Trust, the Endangered Species Recovery Program at CSU Stanislaus, USFWS, Point Blue Conservation Science, California Trout, East Stanislaus RCD, and community volunteers. The goals of the multi-benefit project include floodplain reconnection, flood safety improvement, and habitat creation for threatened and endangered species including numerous riparian birds. We estimated the potential value of the Dos Rios Ranch restoration project in terms of how many additional breeding riparian landbirds the project could deliver. This restoration project is expected to contribute 25% of the Central Valley Joint Venture's short-term (10-year) riparian vegetation objectives and a significant proportion of the riparian landbird population objectives for the San Joaquin region. Ongoing bird population surveys will evaluate the success of the project in achieving these results and help track progress toward achieving the Central Valley Joint Venture's short- and long-term goals.

A Selected Review of Riparian Restoration and Revegetation Techniques Applied in the San Joaquin River Basin
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A variety of small and large scale river and riparian restoration projects have been completed in the San Joaquin River Basin since the mid- to late 1990's. These projects included common objectives for riparian revegetation, but the techniques to achieve the objectives varied widely from site to site. This presentation will give a review of several different approaches used for revegetation on river restoration projects on the Merced, Tuolumne, Stanislaus, and San Joaquin River, including a comparison of vegetation palates, planting techniques and site specific pros and cons that can be applicable to revegetation approaches for the San Joaquin River Restoration Program.