Historical Ecology and Landscape Scale Restoration: Application to the McCormack-Williamson Tract

Julie Beagle, San Francisco Estuary Institute, julieb@sfei.org
Robin Grossinger, San Francisco Estuary Institute, robin@sfei.org
Alison Whipple, San Francisco Estuary Institute, Alison@sfei.org

Historical ecology encourages a landscape-level perspective for restoration through improved understanding of how historical patterns and processes shaped habitat in the recent past. This conceptual understanding of landscapes can be used to evaluate current conditions and develop future scenarios. We used the recently-completed picture of the historical Delta landscape to explore opportunities for the McCormack-Williamson Tract (MWT), a 1600-acre tract along the Mokelumne River. This site provides an example of balancing contemporary constraints to restoration (including existing infrastructure and flood protection concerns) with the goals of landscape-scale restoration.

We placed the site within the larger pattern of historical Delta landscapes and related local habitat patterns to the controlling physical gradients using historical data and conceptual models. This aided interpretation of the contemporary physical landscape and identified opportunities and constraints to landscape-scale restoration. The historical record revealed features such as lakes, natural levees, and tidal channels that could be strategically incorporated into the restoration vision. This perspective helped focus restoration options, including the relative proportion and placement of different habitats and physical features within project design constraints, maximizing the site's potential. The approach also identified opportunities to improve ecological connectivity and long-term adaptability to sea level rise and other environmental changes. A central component of translating the historical landscape perspective to site-scale design was envisioning a process that spanned a short-term vision of restoration possible within the site's bounds, within in the context of a longer-term vision for the Delta.

The project should increase the likelihood of successful restoration design for the MWT and provide a strong rationale for expected ecological functions. From a regional perspective, this local-scale/landscape-scale approach illustrates the value of understanding different landscapes of the historical Delta and connects restoration at MWT to restoration principles and strategies being developed for the Delta regionally.

Keywords: landscape-scale, restoration, historical ecology, ecological functions

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Suisun Marsh Historical Ecology: Notoriously Swampy and Overflowed Lands

Amber Manfree*, UC Davis, admanfree@ucdavis.edu

I have been assessing the deep and recent history of Suisun Marsh as a contribution to a book on the future of the Marsh. Synthesis of information from historic maps, early explorers' accounts, and other sources reveals that, for the past 6,000 years, it has been a place of constant – and relatively rapid – geomorphic and ecological change. In addition to the natural variability of a large marsh situated in the estuarine transition zone, human- and animal-landscape interactions prior to European contact were ecologically significant. Shifts in human and animal populations during the Spanish and Mexican eras, followed by agricultural development and duck club management, have kept the marsh landscape continually in flux. The rate and quality of change has intensified since European contact in 1769 and even more since the Gold Rush. Management agreements in the past 40 years have been based on relatively recent conditions, and do not address the immense variability and complexity inherent in the region, or the increasing importance of the Marsh for protecting native plants and animals in the San Francisco Estuary. Understanding both the deep and recent history of the Marsh provides insights which inform management approaches, point to potential restoration and rehabilitation targets, and alter attitudes about appropriate human-landscape interactions.

Keywords: Suisun, marsh, environmental, landscape, ecology, history

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Management Considerations Associated with Large-Scale Ecosystem Restoration

Curt Schmutte, State Federal Contractors Water Agency, CSchmutte@mwdh2o.com
Byron Buck, State Federal Contractors Water Agency,

Restoration actions contemplated for the Sacramento-San Joaquin Delta must occur at the landscape scale to achieve replication of historic habitat functions and meet the key restoration requirements established by the Bay Delta Conservation Plan, regulatory biological opinions and the Suisun Marsh Plan. The number and pace of acres that would need to be restored is unprecedented. There are inherent challenges in such an massive undertaking, not the least of which is land acquisition and overcoming land speculation that threatens to complicate the assemblage of necessary lands. This presentation will examine key constraints, opportunities and challenges associated with large-scale land acquisition and habitat restoration.

Water agencies may develop habitat by securing lands suitable for habitat restoration through traditional direct fee/easement purchase and development, joint public-private partnerships or competitively priced, completed restoration. Public agencies are bound by appraised fair market land prices and the wise expenditure of public funds to maximize the restoration benefits. The State Federal Contractors Water Agency has determined that development of habitat projects on a large scale is far more cost-effective and biologically prudent than acquisition of random, small "postage-stamp" parcels. Accordingly, the implementing agencies are coordinating efforts to act in unison and are not proposing to entertain purchase of expensive habitat credits from mitigation banks as a mechanism to advance habitat restoration. However, if privately developed, fully functioning habitat can be provided at equal or greater habitat value and at a cost less than comparable agency-developed projects, it would be considered. Therefore, it is in the public's interest to clarify acquisition efforts, create competitive opportunities for privately developed efficiencies and dampen harmful unrealistic expectations.

Keywords: Landscape-Scale Restoration

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Delta Working Landscapes

Michael Machado, Delta Protection Commission, marc.ceccarelli@delta.ca.gov

The Delta Protection Commission's Delta Working Landscapes program encourages farmland to be utilized as valuable habitat by providing opportunities for private landowners to incorporate wildlife friendly farming with current agricultural practices. Currently, attention and effort is being focused on restoring the natural habitats of the Sacramento-San Joaquin Delta to support aquatic and terrestrial wildlife that may have negative impacts to the Delta's economy and culture. Working Landscapes projects provide benefits over traditional ecological restoration projects as the land remains in agricultural production, thus continuing to contribute to the overall economic sustainability of the Delta while encouraging local citizens to serve as environmental stewards of the landscape.

Approach

Delta Working Landscapes approaches these problems through a variety of methods. Planting vegetative buffers along irrigation ditch banks and hedgerow plantings improve water quality by reducing runoff of pesticides and sediment. Farm cultural practices which can benefit for wildlife friendly agriculture, such as rice, corn and wheat fields have been identified and have implemented seasonal flooding and restoration to increase winter wildlife habitats. These projects have additionally supported water quality improvement, salinity control, subsidence reversal, and weed control.

Results

The Delta Working Landscapes projects improve the environmental quality of existing landscapes in the Delta; coordinate programs with local farmers to understand the social, economical, environmental and governmental policy hurdles and incentives to perform conservation practices; and communicate to farmers the advantages of implementing wildlife friendly agricultural practices.

Conclusions / Relevance

- Partnerships between public and private efforts are possible
- Delta farmers have a strong interest in agricultural and wildlife conservation
- Delta farmers understand the importance of improving the existing quality for future generations
- Working Landscape Projects can be the key for a sustainable Delta

Keywords: Delta, Working, Landscapes, Protection, Commission

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South Bay Salt Pond Restoration Project: Overview and Updates

John Bourgeois, California Coastal Conservnacy, jbourgeois@scc.ca.gov
Laura Valoppi, USGS, laura_valoppi@usgs.gov
Cheryl Strong, USFWS, Cheryl_Strong@fws.gov

The South Bay Salt Pond Restoration Project (www.southbayrestoration.org) is the largest wetlands restoration project on the West coast of the United States. It is unique not only for its size– over 15,000 acres—but for its location in the middle of one of the nation's largest urban areas, home to over 3 million people. The Project is intended to restore and enhance wetlands in South San Francisco Bay while providing for flood management and wildlife-oriented public access and recreation.

We have identified long-term alternatives for the Project, each representing a continuum toward different end-states: one end-state at 50% of the existing ponds converted to managed ponds for waterbirds and 50% restored to salt marsh habitat, and the other end of the continuum at 10% of the existing ponds converted to managed ponds and 90% restored to marsh habitat. The final mixture of managed ponds to salt marsh habitat will depend upon the outcome of the Adaptive Management Plan, which will be implemented over the next 50 years and will allow for lessons learned from earlier phases and applied studies to be incorporated into subsequent stages as management plans and designs of future actions are updated.

This presentation will provide an overview of the restoration actions completed to date in Phase 1. At the completion of Phase 1 actions, there will be 1600 acres of tidal marsh restoration, 1440 acres of muted tidal restoration, 710 acres of reconfigured ponds, and 7 miles of new trails. The presentation will also set the stage for the series of technical talks addressing specific key uncertainties in the talks to follow.

Keywords: wetland restoration; adaptive management

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Implementing the Habitat Restoration Requirements of the Biological Opinions: DWR/DFG Fish Restoration Program Agreement Implementation Strategy

Dennis McEwan, CA Department of Water Resources, dmcewan@water.ca.gov
Dan Riordan, CA Department of Water Resources, driordan@water.ca.gov
Gina Benigno, CA Department of Water Resources, gbenigno@water.ca.gov
Ling-ru Chu, CA Department of Water Resources, lchu@water.ca.gov
Pam Lindholm, CA Department of Water Resources, plindhol@water.ca.gov

In response to population declines of endangered native fish, management directives require the restoration of many thousands of acres of tidal wetland habitat in the Delta. DWR and DFG have entered into a cooperative program called the Fish Restoration Program Agreement (FRPA) to actively address this need. In its first year, the FRPA Program has completed an Implementation Strategy for the habitat restoration requirements called for in the NMFS salmon Biological Opinion, FWS delta smelt Biological Opinion, and DFG longfin smelt Incidental Take Permit. The FRPA Implementation Strategy outlines our approach to implementing habitat restoration actions, highlights some early implementation projects that have already been identified, and provides guidelines for finding future restoration sites to fulfill restoration requirements. The scientific principals underlying the development of project design alternatives will be discussed. Additionally, all FRPA restoration projects will have an associated monitoring and adaptive management plan, to ensure proper ecosystem functioning. To ensure consistency and comparability of monitoring data between projects, we are in the process of developing a delta-wide tidal habitat restoration monitoring plan, which will include the opportunity to conduct special studies to help address key uncertainties associated with habitat restoration in the delta. We highlight some early implementation projects, which primarily occur in the Cache Slough region of the northern delta. Projects including Calhoun Cut, Yolo Ranch, and Prospect Island are currently in various stages of the planning process. As technical activities develop, FRPA is actively seeking open and transparent opportunities to discuss progress with stakeholders. While there will be challenges and impediments to restoration as projects progress, FRPA is making progress toward fulfilling the tidal wetland habitat restoration requirements aimed at restoring native fish populations.

Keywords: restoration, tidal wetland, marsh, cache slough complex, smelt, salmon

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Issues and Challenges to Restoration at the Landscape Scale – The Whole is More Than the Sum of its Parts

Michelle Orr, ESA PWA, morr@esassoc.com

Regional-scale restoration presents opportunities to restore significant ecosystem benefits. It also introduces complexities that don't typically come into play for smaller restorations. Because of this, successful restoration of larger areas requires more than extrapolating from the experience of smaller sites. This presentation draws primarily on wetland restoration examples from the San Francisco Bay-Delta, with select comparisons to other regional restoration efforts. Projects planned for the Bay-Delta total tens of thousands of acres and would approximately double the extent of tidal habitats. By virtue of their scale, larger restorations have the potential to affect regional processes such as estuarine sedimentation, tidal hydrodynamics, and salinity regime. Successful planning requires that these regional changes are considered in terms of how they affect offsite land uses and the restored areas themselves. Outside the restored areas, these changes can affect drainage and flooding, navigation, dredging, and wind-wave erosion of levees and existing habitat. Within the restored areas, these changes can affect the evolution of habitats and achievement of restoration goals. Adaptive management is generally recognized as an important component of managing uncertainty in large-scale restoration implementation. What is meant by adaptive management, however, varies greatly depending on who you ask. This presentation will compare and contrast adaptive management approaches in use in San Francisco Bay, the Delta, and coastal Louisiana.

Keywords: regional, wetland restoration, adaptive management

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Time Heals All: Reconciling Conflicting Restoration Goals

Christopher Enright, Delta Science Program, cenright@deltacouncil.ca.gov

Investigations of the historical landscape reveal the characteristic scale and repeating pattern of landscape elements like seasonal freshwater lakes and dendritic tidal creeks and their interaction with natural flows. Yet, applying this understanding to restoration strategies must confront the fact that we begin degraded: Today, Delta land is subsided and severely disconnected from the estuary. Restoration efforts will require decades to return some native landscape forms and functions, even as several native species are in peril. Restorations therefore must do it all: At once recover landscape features and elevation while functioning adequately for native species in the interim.

This talk attempts to reconcile these two ideas with a synthesis of estuarine landscape restoration understanding. First, restoration of native tidal marsh function depends on recovering characteristic forms including vegetated marsh plains elevated near the top of the tidal frame and incised by branching sloughs. This multi-decade process will require, at a minimum, restoration designs that import sediment while vegetation colonizes expanding edges where sediment can be trapped. The trajectory of this sedimentation-vegetation feedback should be a key restoration performance metric that, in turn, depends on properly scaling tide, river, and wind forcing to the dynamic impedance of projects. Second, in the interim decades, restorations must function adequately for native species even as the land water interface is dominated by deep intertidal and shallow subtidal forms. Many native nekton first seek suitable dynamic conditions like fluvial and tidal currents, temperature, and salinity. Once there, organisms use the available structural habitats to find food and refuge. Where dynamic habitats overlap reliably with diverse structural habitat options, native species production can be resilient, even on the interim landscape. Understanding and managing the dynamics of restoration projects will require far more focused and capable modeling, science and management structures than exist today.

Keywords: Restoration scale, reconciliation, land-water interface, natural flow, habitat structure

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Connecting Wetland Restoration and Subsidence Reversal to the Carbon Market

Stephen Crooks, ESA PWA, SCrooks@esassoc.com

The Delta is a highly fragile system, with rising sea level and ongoing land subsidence the risk of levee failure grows. A significant earthquake could potentially flood multiple islands, which if abandoned could permanently change the hydrology and ecology of, and drinking water supply from, the Delta. Restoration activities under BDCP are focused upon the Delta margins, ignoring the deeply subsided central region. Should the Central Delta fail the resiliency of these restoration activities will be questionable. Against this backdrop, some 5 x 10^6 tCO2 are released from Delta organic soils, contributing to California's GHG emissions.

Subsidence reversal, the rebuilding of organic soils through simple water management and tule growth, has been demonstrated to be achievable. If adopted on a large-scale, this activity has potential to reverse Delta fragility, reverse historic GHG emissions, and contribute to long-term ecosystem restoration. While challenges remain, significant hurdles are being overcome. By the time of this conference, the Verified Carbon Standards, a world-leading registry for land-based carbon projects is expected to be on the verge of adopting a change in their rules allowing for the submission of *wetland restoration and conservation* methodologies and projects. The next critical step, the drafting of a methodology setting monitoring and reporting requirements for carbon projects in the Delta, is in progress and may be available for deployment by the summer of 2013. The potential to connect Delta restoration to carbon financing is becoming a reality.

Over the past century we have dug ourselves into an ever deepening hole; literally 2.5 billion cubic meters in size. While not a panacea, by next year we may have an additional financing tool to dig ourselves out. Now is the time to integrate subsidence reversal and carbon sequestration into landscape level planning, identifying barriers to implementation and opportunities for landowners and managers.

Keywords: wetland blue carbon peat landscape planning climate change adaptation mitigation

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Solutions for Landscape-Scale Restoration Challenges

Eric Ginney, ESA PWA, eginney@esassoc.com

The preceding speakers in this session addressed a range challenges related to planning, designing and implementing landscape-scale restoration actions in the Sacramento-San Joaquin Delta and the adjacent lowland river systems. While many of the challenges are related to human-induced issues (i.e., property speculation) and are inherently difficult to address, some of the technical challenges would benefit from additional structure and focus upon the problems.

This presentation will summarize some of the key challenges presented by earlier presenters and will offer potential solutions, emphasizing two technical aspects. The first is the development and use of conceptual models to identify, understand, and quantify benefits for landscape-scale processes. An applied case study illustrates the need of such an effort and explores how such a tool illustrates benefits not visible with an approach that examines smaller-scale processes. The model and its use would greatly benefit regional planning within the estuary and would assist in relating different regions (and processes) and integrating restoration across regions to achieve landscape-scale results.

The second aspect addresses the development of a framework to support assessment and organization of hydrodynamic model results and their relation to restoration planning and estuary research. The framework, which uses the landscape-scale conceptual model as a foundation, would create a common place of understanding as restoration design (at a parcel and regional scale) begins to accelerate. The framework will help restoration designers to maintain a consistent understanding and vision for desirable hydrodynamic and geomorphic processes (at a landscape scale), and assist in establishing a common set of goals related to a desired threshold/magnitude and location of certain processes. Further, this framework will help all entities involved in restoration to understand how the estuary's "existing conditions" evolve through time as restoration advances by tracking process change through time and relating it to landscape function.

Keywords: conceptual model; restoration; landscape-scale; regional planning; design;

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