Resilient Landscapes: A Science-based Approach to Creating Recommendations for How to Return Desired Functions to Highly Altered Ecosystems.

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The Bay Area faces environmental challenges that include rapid climate change, extinctions, natural systems stressed to the breaking point, and increasing human population. The necessity of addressing these issues creates an opportunity to re-envision our landscapes so they can support prosperous human and wildlife populations. Urbanization and natural resource exploitation occurred in particular patterns related to regional history. These patterns can now be revised over the coming decades to reflect new science, new stressors, and new societal values. This presentation details one approach to such a revision, which is based in a landscape resilience framework that we synthesized from the academic literature of resilience theory. To support desired functions (like support of native wildlife or delivery of clean drinking water) over the long term, landscapes must continue to provide the function in the face of gradual change and pulse disturbances.

Our approach to developing recommendations for achieving resilient landscapes starts with understanding how the landscape functioned in the relatively recent history of California prior to significant European development. This investigation into historical ecology illuminates the natural physical and chemical processes of the land and water and how they interacted with biological processes to support habitat types and wildlife populations. Then we analyze contemporary data to quantify landscape change related to loss of desired ecological functions. Finally, we identify opportunities and constraints to returning functions by restoring or emulating key physical and biological processes. This approach takes a large-scale, long-term view, which allows for different parts of the landscape to provide different functions and for actions to be implemented in phases over decades. Examples of how this approach is being applied through the Delta Landscapes Project and Resilient Silicon Valley will be briefly mentioned and more fully discussed in the "Resilient Silicon Valley" presentation and the "Re-envisioning the Delta" special session.

Keywords: Ecosystem Restoration, Reconciliation Ecology, Landscape Ecology, Resilience
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Restoration Tells a Story: Mapping of Delta Habitat Projects, Data and Science

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Where are habitat restoration projects in the Delta and what are we learning from them? In order to answer these questions in a compelling way, we find maps to be a great tool of expression. Also, maps are most powerful when they tell a story. Combining geospatial data with interactive maps, research findings with multimedia (photos, videos, text, 3d images), and habitat projects with environmental datasets, provides an engaging way to communicate and deliver a message about habitat restoration in the Bay-Delta system. We used story map technology to develop narratives about past Delta restoration projects by incorporating locations of restored, managed and historical wetlands, floodplain and flooded islands. We then linked restoration projects to geospatial datasets such as land elevation, channel network, levees infrastructure, vegetation cover and land use. We reviewed relevant research, published studies and available literature and linked the collated information to project locations. What has emerged is a visual story connecting restored areas to environmental datasets, research findings and lessons learned. The restoration story map presents acquired knowledge from past restoration projects and identifies remaining challenges that stand in the way of achieving better restoration success in the Delta and Suisun Marsh. The Delta restoration projects story map is one of many possible ways to effectively visualize, communicate and deliver habitat restoration information to Delta restoration practitioners, decision makers and the public. This tool can also complement the last phases of the Delta Plan adaptive management framework, “communicate current understanding and adapt.”

Keywords: gis, story map, restoration, interactive, communication
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Southport Levee Setback Project: Ecologically Functional Floodplains Under Construction on the Sacramento River

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The presentation focuses on a 4-mile reach of the Sacramento River downstream of the City of Sacramento, where a major levee setback is schedule for construction starting in 2016 as a part of a multi-objective flood control and habitat restoration effort. This project represents an important step towards combining flood risk reduction with significant ecological enhancement.

An update is provided on the multi-disciplinary approach employed to integrate hydrodynamic modeling with geomorphic interpretation to maximize the restoration benefits that were incorporated into the design of this levee setback project. The approach utilized a 2-dimensional hydrodynamic and morphological model as an analytical tool for assessing the dynamics of floodplain inundation under existing and design conditions for a 12-mile reach of the Sacramento River. The assessment was used to support recommendations for ecosystem enhancement actions that optimized both geomorphic and ecologic function. The analysis provided insight into the geomorphic evolution of the study reach under the design condition and this insight was used to develop strategies for long-term floodplain management. The benefits of using a 2-dimensional hydrodynamic / sediment transport model as a tool to describe geomorphic processes and inform restoration design is emphasized.

A discussion is provided relating to how these types of levee setbacks represent of a significant opportunity for the future; as means of achieving both increased flood protection and habitat restoration and in turn, providing multiple benefits to society. This floodplain management approach is illustrative of one of the most promising solutions to the current levee integrity/ flood management crisis in California.

Keywords: Levees, setbacks, hydrodynamic and mgnrpologic modeling, restoration.
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Resilient Silicon Valley: Increasing Landscape Resilience through Interdisciplinary Science and Multi-Sector Collaboration

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Famously referred to as the “Urbanized Estuary," the San Francisco Bay-Delta Estuary is largely surrounded by cities. As we work to create a healthier estuary in the face of climate change and other stressors, we are increasingly recognizing the importance of redesigning our urban landscapes to support prosperous human and wildlife populations. The urban margins must provide more habitat and connectivity for wildlife, offer transition zones for sea level rise migration, treat runoff, and deliver sediment to sustain the estuary. Fortunately, trends towards urban greening, Low Impact Development, bayside redevelopment, and green transportation present opportunities to redesign these landscapes to better sustain physical and biological processes. However, the positive effects of these diverse activities are currently limited by the lack of technical guidance, multi-partner coordination, and successful demonstration examples.

To address this need, we are working with multiple sectors in Santa Clara Valley to develop an integrated, multi-benefit approach to ecological resilience. In its first year, Resilient Silicon Valley produced a vision for landscape resilience that connects objectives across the Baylands, Valley, Streams, and Hills. The RSV Vision applies the Landscape Resilience Framework, which synthesizes current resilience science and theory into a holistic framework for improving resilience at the landscape scale (and is discussed in the Resilient Landscapes presentation). The initial RSV vision is being applied through collaborations with Google, Santa Clara Valley Water District, and other agencies and NGOs. Using this foundation, more detailed visions are being developed for specific portions of the valley and specific strategies to translate the technical guidance into local policies, plans, and projects. RSV and similar integrative, catalytic efforts have the potential to transform our urban areas to increasingly support the natural processes underlying the health and resilience of both people and wildlife.

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Improving Habitat Along Delta Levees

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Most of the historical riparian habitat along Delta waterways has been lost, as 1,100 miles of levees were erected, many armored with riprap. These modifications to the Delta helped establish and protect the Delta's productive farmland, but also greatly reduced the channels' ability to support native fish and wildlife. Recognizing this problem, the Legislature required the Delta Levees Program achieve a "net long-term habitat improvement." Additionally, the Delta Reform Act calls for improving river corridors for fish, birds and other animals.

The Delta Stewardship Council recently released the report *Improving Habitats Along Delta Levees* to support the development of the Council's Delta Levee Investment Strategy. Since this Strategy primarily focuses on prioritizing State investments in Delta levees to reduce flood risks, this report provides guidance so those investments can also contribute to long-term improvement of river corridors.

Through review of monitoring reports and interviews with experts for 15 levee habitat improvement projects in and near the Delta, we learned that most monitoring focused solely on vegetation performance and few projects evaluated species' response to habitat improvements. We also recognized the challenges that small, local reclamation districts face, maintaining their levees while also trying to improve habitat. Although we couldn't draw firm conclusions about effectiveness of past projects, we summarize lessons learned about which habitat designs may provide greater benefits to native species. The report also includes recommendations about how to better assess project effectiveness in the future. One recommendation is creating a standardized regional monitoring program to make it easier to compare results of habitat improvements across levee projects and relieving the direct responsibility of implementing a scientifically-robust monitoring program from reclamation districts. Another recommendation is for monitoring of levee projects to incorporate appropriate performance measures, including fish and wildlife response, to assess effectiveness of projects to benefit target species.

Keywords: Adaptive Management; Levees; Channel Margin Habitat; Riparian Habitat; Effectiveness Monitoring
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