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LANDSCAPE-SCALE RESTORATION IN THE SACRAMENTO SAN JOAQUIN DELTA: RECONCILING PROPERTIES WITH PROJECTS FOR BETTER ECOLOGICAL PERFORMANCE, LESS COST, AND STAKEHOLDER ACCEPTANCE

BY CHRIS ENRIGHT, STUART SIEGEL, ROBIN GROSSINGER & LEO WINTERNITZ

Large-scale ecosystem restoration in the Sacramento San Joaquin Delta is planned for the coming decades to conserve native species. The authors believe that restoration planning should fundamentally embrace a landscape perspective using adaptive scientific assessment methods to define operational landscape units for the best chance at long-run success. Focusing restoration at landscape scales also lowers costs by reducing permitting effort, creating more land acquisition options, and encouraging broader acceptance of restoration for the future of the Delta. Despite these advantages, regulatory drivers oblige responsible public agencies to dismiss the long-term view required for landscape scaling in favor of acquiring and quickly reconnecting properties with problematic levee boundaries. We propose several advantages of restoration at the landscape scale and the institutional changes required to incentivize a landscape restoration perspective.

The Sacramento-San Joaquin Delta has been transformed over the last century as tidal marshes have been disconnected and over seven hundred thousand acres substantially subsided. The connections within the Delta and between adjacent floodplains are profoundly sensitive to geomorphic change through river and tidal energy dynamics. Restoring connections in ways that favor native species and meet flood management and water supply goals will be challenging on many fronts. We know that restoration opportunities will arise in an uncertain sequence. Reconnected land and water will cascade effects Delta-wide on hydrodynamics, geomorphology, water chemistry, and ecology. Progress will be challenging to assess because each restoration strongly affects previous restorations and, in turn, is affected by those yet to come. Incremental restoration actions will continuously shift the Delta baseline, including the ecosystem effects of Delta flows. Other ecosystem stressors like invasive species and contaminants will interfere with uncertain timing and effect. Large-scale restoration is therefore not so much about final outcomes because the Delta system state won't hold still long enough to distinguish restoration signals from powerful ecosystem effects. Rather, the adaptive management challenge is to actively steer the trajectory of landscape change toward functions that support native species over time.

It will be equally challenging to make Delta ecosystem restoration acceptable to diverse stakeholders. Though the extent and pace of proposed future Delta restoration is unprecedented, restoration actions so far have taken years to complete, hamstrung by permit requirements, Delta neighbor apprehension, and scientific and regulatory uncertainty. Nevertheless, public agencies responsible for restoration have acreage requirements that must be met on a legally demanding schedule. In parallel, the Delta community is understandably apprehensive about how restoration projects affect the Delta's future. Delta stakeholders are concerned about flood protection, the Delta agricultural and recreation economy, and the heritage value of the Delta as an evolving place.

An adaptive landscape vision: Strategic assessment tools and operational landscape units

Scientific assessments are needed about how land-water connections, natural processes, and spatial patterns improve native species persistence in the Delta. A key assessment will be to determine effective operational scales and connectivity that repair natural ecological patterns and processes. These "operational landscape units" (OLU's) help us avoid the risk of implementing many small, disconnected restoration actions that fail to restore functional ecosystems. An OLU (after Verhoeven) is a naturally-defined geomorphic unit where there is potential to reestablish higher-level ecological functions and processes through adaptive restoration, science, and management. In parallel, the Delta is also a complex social system that requires broadly-supported visions of regional restoration. Strategic assessments must encompass both social and ecological imperatives in an adaptive assessment environment. They should offer a landscape-level vision and adaptive conceptual model describing the geographic template, ecological targets, associated physical process/ management requirements, and steps needed to advance the vision. The landscape vision should directly inform restoration planning through a set of explicit, geographically based landscape and ecosystem target metrics.

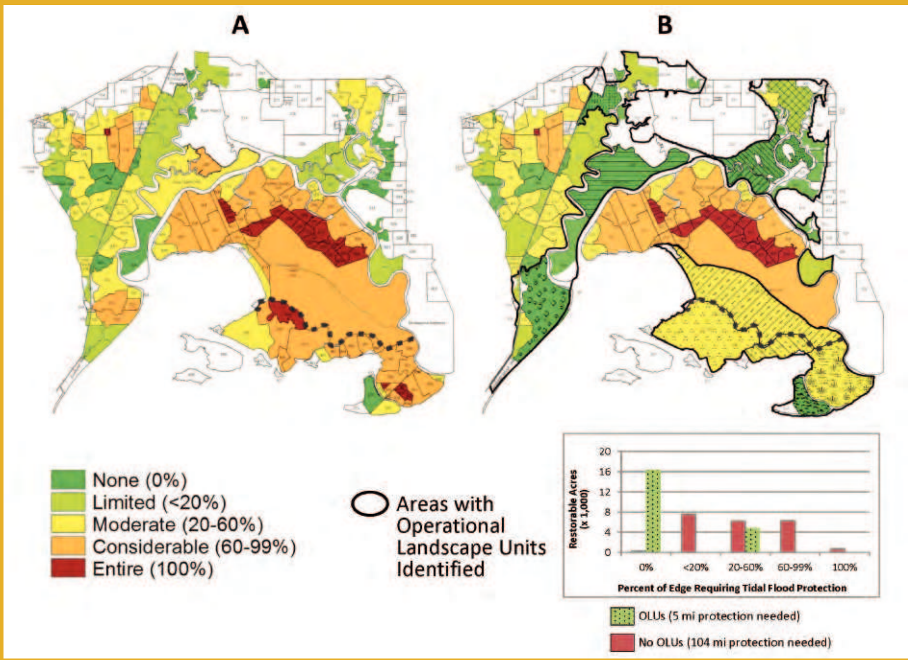

Figure 1 - One possible realization of how "operational landscape units" would reduce flood protection needs in the Suisun Marsh region of the California Delta. Colors indicate the percent of property edge requring flood protection
A - Restoration of individual properties
B - Restoration of identified operational landscape units – about half of Suisun Marsh

Figure 2 - Individual properties acquired for restoration in Suisun Marsh. Both projects require reinforced levees to protect adjacent properties while leaving historical tidal marsh features disconnected. The authors propose holding and managing properties like these for other benefits until landscape-scaled connections can be made

These metrics can help evaluate projects, the interactions between them, and trajectories of Delta ecological performance (Figure 1).

Recently there is broader understanding that landscape visions are a key to successful native species recovery. Unfortunately, the institutional relationships that enforce and implement biological opinion requirements and habitat conservation plans inadvertently encourage insular restoration of acquired properties. Public and private properties with restoration potential often have complex boundaries that comport little with ecological patterns and processes that would support competitive advantage for native species. For example, tidal marshes in the Suisun Marsh region of the San Francisco estuary have been converted to over one-hundred fifty waterfowl hunting properties, disconnecting dendritic tidal channel networks and grading out low-order channels. Property boundaries often cut directly across tidal channel networks with berms for water level control that limit ecosystem exchanges (Figure 2). Individual property restoration usually requires reinforced levees to protect neighboring properties with attendant cost and risks. Recovering tidal geomorphic patterns and processes is difficult where levees short-circuit natural marsh-building processes.

We argue that a strategic, creative, and patient approach to land acquisition, management, and restoration planning will achieve desired ecological outcomes over time at far less cost and social conflict. This will require new approaches including establishing "acquire-and-hold" as a key strategy. That is, encourage acquired properties with inadequate landscape scale to be held in productive interim land uses until an OLU can be established over time. Many advantages will accrue:

Less levee extent to protect. Operational landscape units work because they connect aquatic, intertidal, and upland habitats reminiscent of historical patterns. Most public and private properties border other properties with a levee between. When multiple properties comprise an OLU, levee boundaries can be removed along with attendant economic and ecological cost.

Fewer neighbor conflicts. Incompatible adjacent land uses can arise when restoration projects have neighbors. Depending on the land use, complaints can surface about issues like mosquito abatement, public access and liability, levee seepage, and safe harbor for endangered species. Restoration at landscape scales would connect properties into geomorphically and ecologically effective units where boundaries are more likely to be channel and bay edges.

Fewer restoration projects and required permits. Connecting properties into OLU's for restoration would reduce the number of individual restoration projects and thus the number of associated environmental permits, resulting in far less planning costs and effort.

More time for adaptive analysis and planning. An "acquire-and-hold" strategy allows adaptive analysis and decision making that considers multiple social and economic opportunities together with the complex hydrodynamic, geomorphic, and ecological cascade each restoration project will activate. Integrating restoration goals with flood management, water supply, and agricultural goals requires a dynamic whole-system view. To work, new interdisciplinary science and management competencies must be developed that emphasize system modeling, decision support tools, and advanced data analysis.

More acquisition instruments, less land speculation. Emphasizing a landscape perspective through OLU's encourages a greater diversity of acquisition instruments because time and analysis become assets rather than liabilities (as they are perceived today). Land swaps, conservation easements, rent back, options-to-buy etc., encourage landowner participation because payments can be made now for future options. This approach may also reduce restoration land speculation and spiraling land values. In the meantime, existing land uses can optionally continue for years to decades.

Improved Delta community acceptance. The more patient approach to restoration required by OLU's affords more time for the Delta community to understand and participate in restoration change. Community apprehensions are eased as neighbor conflicts diminish, acquisitions are creatively tailored to fit diverse needs, and present payments are made for future options. Large-scale restorations also lend themselves to better flood management alternatives which are desired by Delta communities. OLU's may also provide better public land experiences that would attract visitors and economic activity to the Delta.

More effective for natural process restoration. Floodplains and tidal marshes are patterned by tides, river flows, sediment, and vegetation processes. Forcing these drivers to work in constrained spaces defined by artificial property boundaries prevent natural landform recovery processes from working. Levees become necessary controls with ongoing cost and liability and often with unintended ecological consequences. A patient approach to long-term restoration affords options and time to adaptively connect properties into OLU's that leverage natural process and recover landforms and biophysical gradients that native species can use to competitive advantage.

Needed changes in the restoration management approach

Realizing the advantages of landscape-scale restoration will require new institutional approaches. First, permitting agencies must reframe their directives to allow for longer timeframes of action. Restoration planning must accommodate emerging landscape scaling opportunities that create fewer, less costly, and more ecologically effective projects over time. Second, permitting agencies should devise more programmatic mechanisms for environmental analysis and permitting and encourage performance metrics that are tied to landscape scales and dynamic long-term outcomes. Third, the mismatch of property scales and effective landscape scales can be remedied by "acquire-and-hold" strategies that allow adaptive assembly of OLU's. Fourth, acquire-and-hold will require interim land management for public benefits. Many options are available including carbon sequestration which can both prepare restorations for more effective connection and mitigate greenhouse gases. Existing land uses, flood management, recreation, and conservation of other species can be integrated in. Finally, the landscape perspective will require adaptive planning, scientific assessment and skillful social interactions as the landscape changes. This will be accomplished best by assigning restoration responsibility and authority to a trusted science and management organization with interdisciplinary skills and long-term mission to recover native species in the most effective and socially acceptable way.

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