DELTA SCIENCE FELLOW 2016

Delta Stewardship Council
Delta Science Program

Sea Grant California

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WHY THIS RESEARCH MATTERS

River floodplain environments support some of the world's most diverse and productive ecosystems, yet they have been deeply disrupted by human activities. Managing for dynamic processes that support freshwater ecosystems requires improved understanding and quantification of river-floodplain interaction. Understanding a floodplain's hydrospatial regime–the patterns of flooding over time and space–and related habitat availability can provide key insights for flow management and restoration efforts in the Delta and beyond. The results of this project could inform more effective and efficient water management and restoration strategies within altered riverine landscapes and under changing future conditions.

Spatio-temporal variation of floodplain habitat for restoration management

Flood at The Nature Conservancy's Oneto-Denier restoration site on the lower Cosumnes River. *Alison Whipple*

PROJECT

The goals of this project were to establish a new approach to quantify floodplain inundation patterns and evaluate floodplain habitat availability and variability under different management scenarios. Whipple's research focused on a recent levee removal restoration project along the lower Cosumnes River near Sacramento. She used hydrodynamic modeling for pre- and post-restoration conditions and the historical streamflow record to estimate metrics such as inundation extent, depth, velocity, connectivity, and duration. She then used habitat criteria for Sacramento splittail, a native floodplain fish, to estimate daily habitat across the floodplain restoration site.

RESULTS

Results from the habitat analysis showed that the lower Cosumnes River levee removal restoration produced a near doubling of available Sacramento splittail habitat. Spawning splittail habitat availability was up to 25% lower than that of juvenile rearing habitat, though both responded similarly to restoration. Habitat benefits were highly variable in space and time. Comparing between years, Whipple found infrequent occurrence

RESULTS (continued)

of extremely high habitat availability. Both before and after restoration, however, more than a quarter of the years were associated with extremely low habitat availability. Spatially, patterns of habitat benefits reflected underlying topography as well as proximity and connectivity to the river. The center of the floodplain site, near the main levee removal, produced the greatest habitat benefits. Only small areas of the floodplain were shown to produce an overall decline in habitat availability.

MANAGEMENT APPLICATIONS

Results suggest that floodplain restoration actions can improve habitat quality and quantity for floodplain fish, even within highly modified landscapes of the Central Valley. This study advances floodplain habitat quantification methods. It retained spatial and temporal resolution throughout the analysis, allowing for spatially or temporally dependent suitability criteria such as connectivity and duration. Overall, this research presents new ways to evaluate floodplain inundation characteristics that are relevant to ecosystems, which can improve analysis of restoration alternatives.

This study provides useful information not only for restoration along the Cosumnes River, but also for floodplain restoration efforts more broadly. The hydrospatial analysis approach developed can be used in water and land planning and management to compare restoration and environmental flow alternatives.

PUBLICATIONS AND PRESENTATIONS

Whipple AA. 2018. Managing flow regimes and landscapes together: Hydrospatial analysis for evaluating spatiotemporal floodplain inundation patterns with restoration and climate change implications. PhD dissertation, University of California, Davis.

Whipple AA. 2017. Supporting Ecosystems in Highly Managed Landscapes: Learning from Process-based Restoration on the Cosumnes River Floodplain, California. *Australian Rivers Institute Seminar Series.* Nathan, Australia. Invited Speaker. August 11, 2017.

Whipple AA, JH Viers, HE Dahlke. 2017. Flood regime typology for floodplain ecosystem management as applied to the unregulated Cosumnes River of California, USA. *Ecohydrology*. e1817.

Whipple AA, WE Fleenor, JH Viers. Quantifying Spatio-temporal Inundation Patterns for Floodplain Restoration on the Lower Cosumnes River, California. *2016 Bay-Delta Science Conference Sacramento*, CA. Poster. November 15, 2016.

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