

Review of Research on the Sacramento-San Joaquin Delta as an Evolving Place



A Review by the
Delta Independent Science Board

April 2017

Created by the Delta Reform Act of 2009 and appointed by the Delta Stewardship Council, the Delta ISB is a standing board of nationally and internationally prominent scientists with appropriate expertise to evaluate the broad range of scientific programs that support adaptive management of the Sacramento-San Joaquin Delta.

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Table of Contents

Summary	1
I. Purpose of this Review	1
II. Reasons to Review Research on Values	1
III. Methods	2
IV. Findings	3
Recent Research on Delta as an Evolving Place	4
<i>“Race, Land, and the Politics of Place-Making in Locke”</i>	4
<i>Delta Levees and Changing Delta Land Use</i>	4
<i>Sense of Place in the Delta</i>	5
<i>Delta Narratives Project</i>	5
<i>Indigenous Knowledge along the Lower Cosumnes River</i>	6
<i>Human Use of Restored and Naturalized Delta Landscapes</i>	6
<i>Evading Dam-Nation: Land Use History of the Lower Cosumnes River Watershed</i>	7
V. Synthesis Opportunities	7
Delta Economic Sustainability Plan	8
Delta Levees Investment Strategy.....	8
VI. Recommendations	9
VII. Conclusion	10
VIII. Acknowledgments	11



Summary

Research on the social and natural processes that sustain the unique values of the Delta as an evolving place is sparse and sporadic. We found seven research projects and no established research programs directly aimed at developing an understanding of the processes supporting the Delta as an evolving place. Far more research occurs on other Delta topics, such as water flows, contaminants and nutrients, and at risk species. Nor did we find evidence that research in these other areas is identifying natural processes that could protect and enhance the values of the changing Delta.

We therefore recommend an expanded, sustained commitment to research on the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place. The level of effort could resemble that in other Delta subject areas. Priority should be given to research that supports achieving the coequal goals in a manner that protects and enhances these unique values.

Purpose of this Review

The Delta Reform Act of 2009 stipulates that the coequal goals of water reliability and habitat restoration “shall be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place” (CA Water Code §85054). The act further directs the Delta Independent Science Board to review science programs in support of adaptive management in the Delta.

This is one of those programmatic reviews. The Board aims to hasten the development of a working understanding of the social and natural processes supporting the values of the Delta as an evolving place.

Reasons to Review Research on Values

It may at first appear that scholarly work on Delta values is beyond the purview of an advisory board that is currently composed of seven natural scientists, two engineers, and an environmental economist. However, as quoted above, the Delta Reform Act of 2009 calls attention to the Delta’s cultural, recreational, natural resource, and agricultural values, and thus implies recognition that effective policies and management decisions about natural resources will require consideration of human history, culture, and values.

The Board argues that a review is needed on the values of the Delta as an evolving place and the social and environmental processes that support those values because:

The Delta Reform Act directs the Delta Independent Science Board to review science programs in support of adaptive management in the Delta. This is one of those programmatic reviews.

Familiarity with Delta scholarship from the social sciences and humanities will help ... promote coupled human-natural systems research for understanding the Delta

1. Policy, management, and implementation decisions based on the natural sciences alone can fall short of achieving their goals by failing to include input from the social sciences and the humanities.
2. The social sciences, including economics through which values can be estimated in monetary terms, are a part of science.
3. Researchers in the natural sciences need to pay attention to the processes of the Delta's terrestrial, hydrological, and biological environment that protect and could be used to enhance the unique values of the Delta as an evolving place.
4. Familiarity with Delta scholarship from the social sciences and humanities will help the Board, the Delta Science Program, and other agencies promote coupled human-natural systems research for understanding the Delta.
5. Delta scientists conduct research to support informed, rational decision-making for policy and management and their implementation. To that end, research effort should be directed to those areas where the lack of information and uncertainties are greatest.

Methods

The Board initiated this review in July 2014. Small subgroups of Board members:

- Met with staff of the Delta Protection Commission (DPC), Executive Director Erik Vink and Senior Planner Blake Roberts.
- Met with Special Advisor Shakoora Azimi-Gaylon of the Delta Conservancy.
- Interviewed Prof. Robert Benedetti, professor emeritus at the University of Pacific and co-leader of the Delta Narratives Project; attended presentations of the Delta Narratives project; and participated in the project's final workshop.
- Engaged with Delta residents at meetings on the Delta Levees Investment Strategy.
- Met with Dr. Brett Milligan, assistant professor of landscape architecture in the Department of Human Ecology at UC Davis, while he was undertaking research on uses of Delta restored and naturalized areas.
- Participated in the second meeting of the Delta Protection Commission's "Delta as Place Interagency Working Group"
- Spoke with the one agricultural extension specialist whose assignment is Delta-wide.
- Searched a database of graduate theses to ascertain whether any graduate student research projects on Delta as Place had remained below the radar of those with whom we had spoken about the topic.

- Participated in a meeting of UC Davis social scientists called to discuss how social scientists might be encouraged to work on Delta as Place through the Delta Science Program’s Science Action Agenda.
- Visited the Dutra Dredging Museum in Rio Vista.

The Board, as a whole, heard Prof. Benedetti, along with Erik Vink and Blake Roberts of the DPC, on Oct. 15, 2015 at the DISB meeting held in Knightsen.

Findings

This review focuses on research that contributes directly to understanding the Delta as an evolving place. We recognize that management and policy stemming from research on water reliability and habitat restoration have consequences for the Delta as an evolving place, but this is currently incidental to, or a byproduct of, research and management decision-making processes, not an objective of research or the interpretation of research results. We illustrate how management for the coequal goals affects the unique values of the Delta as an evolving place in Figure 1.

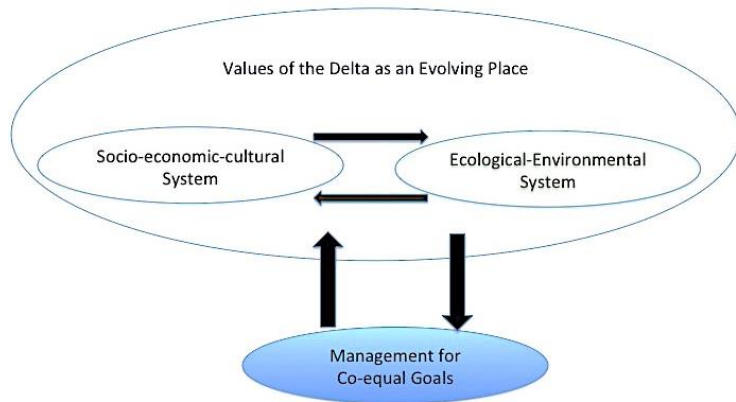


Figure 1. Relationship between Delta as an Evolving Place, illustrated by the interaction of human and natural factors, and the co-equal goals of Water Reliability and Habitat Restoration.

We note that while research on the socio-economic-cultural system and its relationship to Delta values is important, the connecting arrows between the social and environmental system are especially important.

John Thompson’s PhD dissertation, undertaken six decades ago, provided the first comprehensive analysis of the Delta’s physical and cultural geography and their interactions¹. Thompson described the Delta as an evolving social and cultural system in the context of the human transformation of the Delta as a physical and biological system. Since Thompson’s dissertation, there have been important contributions including Martin Michell’s 1993 PhD dissertation, under

¹ Thompson, John. 1957. A Settlement Geography of the Sacramento – San Joaquin Delta, California. PhD dissertation, Geography, Stanford University. <https://watershed.ucdavis.edu/pdf/thompson-dissertation%20small.pdf>

Thompson's supervision, on the modern evolution of the Delta landscape². We also noted excellent contributions to the history of Chinese immigrants in the Delta. These include a 1987 collection of photographs and stories assembled by Jeff Gillenkirk and James Motlow with an excellent bibliography³.

Recent Research on Delta as an Evolving Place

We searched for articles, dissertations, reports, book chapters, and projects that were undertaken in response to the 2009 Delta Reform Act or were undertaken since 2009 and independently contribute to an understanding of the interacting social and natural processes that make the Delta a valued place: culturally, recreationally, agriculturally, and with respect to its natural resources. We found only seven such research projects that we summarize below in chronological order.

"Race, Land, and the Politics of Place-Making in Locke"

Though written during the Delta Vision process that led to the 2009 Act, Gerardo Gambirazzio's 2009 PhD dissertation considers the politics and processes of place-making in Locke, CA, during the urban redevelopment and preservation project conducted by the County of Sacramento and the State of California⁴. This transformed governance and land ownership patterns in the town as part of an attempt to remedy past injustices committed against Chinese and other Asian groups. The study focuses on three groups: the town's residents and the factions they formed, the Sacramento Housing and Redevelopment and California State Parks Agencies, and the dominant Chinese American booster organizations that promoted the historical designation of the town and its preservation. Gambirazzio traced the meaning and experience of all three groups, using a combination of ethnographic, archival and participant-observation methods.

Delta Levees and Changing Delta Land Use

The Delta as a place evolved in a great leap with the construction of levees starting in the later 19th century. Its serious development as an agricultural region followed. The Delta as a place as we now know and value it is dependent on the levees and their continued maintenance. Floods and earthquakes



The Delta as a place evolved in a great leap with the construction of levees starting in the later 19th century

² Mitchell, M.D. 1993. Changes in Landscape Forms and Functions in the Sacramento-San Joaquin Delta, California, 1920-1993. PhD dissertation, Geography, University of Illinois. <https://www.ideals.illinois.edu/handle/2142/72378>

³ Gillenkirk, Jeff and James Motlow. 1987. Bitter Melon: Inside Americas Last Rural Chinese Town. Berkeley. Heyday Books. This document has an excellent bibliography of prior studies. See also: Chan, Sucheng. 1986. This Bitter Soil: The Chinese in California Agriculture, 1860-1910. Berkeley. University of California Press.

⁴ Gambirazzio, G.C. 2009. [The Parallax View: Race, Land and the Politics of Place-Making in Locke, California](#). PhD dissertation, University of California, Davis.

threaten the levees and sea level rise will eventually make their defense impossible. Robin Suddeth, Jeff Mount, and Jay Lund undertook an analysis using available data and decision theory in 2010 that predated the recent Delta Levee Investment Strategy⁵.

Sense of Place in the Delta

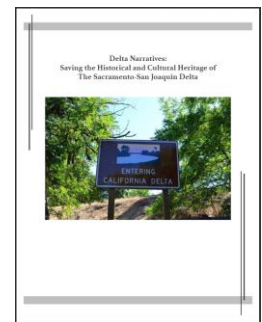
In 2013, Natalie Smith investigated *Sense of Place Impacts for Rural Residents in the Sacramento-San Joaquin River Delta* as a graduate student in Environmental Management at Duke University⁶. Her work was explicitly undertaken in response to the 2009 legislative mandate to consider the values of the Delta as an evolving place. Smith made three significant contributions. First, her review and summary of literature on “sense of place” demonstrated that this literature was applicable to the California Delta. Second, she did a content analysis of the 2010-12 testimonies of Delta residents and interviews of residents. Third, she interviewed a sample of Delta residents that confirmed and provided elaboration for the content analysis. Smith found that Delta residents valued their agricultural heritages, were pleased that the physical landscape had not been altered significantly during the past two decades, and were concerned about future potential changes in the Delta from proposals for water conveyance. Smith recommended that Delta residents’ sense of place be monitored so that it can be protected and enhanced in the process of making decisions on water reliability and habitat restoration.

Delta Narratives Project

The DPC funded a project on Delta history and literature. Known as the Delta Narratives Project, it was directed by Professor Steve Boilard of California State University (CSU) Sacramento. It was co-directed by Professor Emeritus Robert Benedetti of the University of the Pacific and by former Delta Protection Commission Executive Director Margit Aramburu, who was also the former Director of the Natural Resources Institute at the University of the Pacific.

A team of academic scholars, museum archivists, and librarians came together in support of this project during 2014 and 2015. Scholars from CSUs Sacramento and Stanislaus, University of the Pacific, and University of California, Merced identified historical material not easily accessible to the public and prepared Delta “narratives”, *i.e.*, histories that highlight key information pertinent to the Delta today. Local historical societies, public and private museums, and libraries are helping preserve valuable pieces of the Delta story.

The Delta Narratives project has begun to show how these pieces are interrelated, showcasing the Delta region as a historically important region in

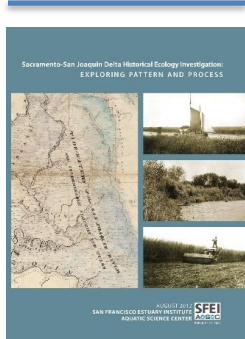


The Delta Narratives lays out an ambitious plan to organize cultural and historical exhibits in the Delta

⁵ Suddeth, R., J.F. Mount, and J.R. Lund. 2010. [Levee Decisions and Sustainability for the Sacramento San Joaquin Delta](#). San Francisco Estuary and Watershed Science, Volume 8, No. 2.

⁶ Smith, Natalie. 2013. [Sense of Place Impacts for Rural Residents in the Sacramento-San Joaquin River Delta](#). Masters Paper in Environmental Management. Duke University.

the United States⁷. The participants have completed the first phase of the study, and the final report lays out an ambitious plan to organize cultural and historical exhibits in the Delta⁸. Financial support for implementing these recommendations, however, is uncertain.



There is a significant literature on how Native Californians modified the ecological landscape

Indigenous Knowledge along the Lower Cosumnes River

There is a significant literature on how Native Californians modified the ecological landscape. Whipple *et al.* in the San Francisco Estuary's Delta Historical Ecology Report (2012) provide an excellent synthesis of the role of Native Californians in the Delta⁹.

Michelle Stevens and Emilie Zelazo wrote a chapter titled "Fire, Floodplains, and Fish: The Historic Ecology of the Lower Cosumnes River Watershed" that synthesized the available literature on how indigenous peoples used their traditional ecological knowledge (TEK) to manage their environment¹⁰. The chapter builds on Stevens' 1999 PhD thesis at UC Davis, combines related material from other indigenous California cultures and ecosystems, and suggests how indigenous practices could contribute to ecological restoration and environmental sustainability.

Human Use of Restored and Naturalized Delta Landscapes

Brett Milligan, Professor of Landscape Architecture at University of California, Davis, and graduate student Alejo Kraus-Polk researched how people use restored and naturalized Delta landscapes for recreation, subsistence, and other activities¹¹. Environmental research on Delta landscapes has either ignored the presence and influence of people or documented environmental reasons why people are a nuisance. Milligan and Kraus-Polk take the perspective

⁷ [Delta Narratives: Saving Historical and Cultural Heritage of The Sacramento-San Joaquin Delta](#). 2015. Prof. Robert Benedetti, University of the Pacific and by Margit Aramburu, CSU-Sacramento. Many Participants - Delta Protection Commission.

⁸ The Delta Narratives project, in the process of identifying and organizing key actors involved in the protection and enhancement of Delta values, assembled an inventory of all of the libraries and museums with material on the Delta that is available at: http://delta.blogs.ca.gov/files/2016/10/Appendix_C_Directory.pdf. The project also has brought together an exceptional bibliography: http://delta.blogs.ca.gov/files/2016/10/Appendix_D_Bibliography.pdf.

⁹ Whipple, A.A., Grossinger, R.M., Rankin, D., Stanford B., Askevold R.A. 2012. Sacramento-San Joaquin Delta Historical Ecology Investigation: Exploring Pattern and Process. http://www.sfei.org/sites/default/files/biblio_files/Delta_HistoricalEcologyStudy_SFEI_ASC_2012_lowres.pdf

¹⁰ Stevens, Michelle and Emilie Zelazo. 2015. Fire, Floodplains, and Fish: The Historic Ecology of the Lower Cosumnes River Watershed. Chapter 6 in Rivers, Fish, and the People: Tradition, Science, and Historical Ecology of Fisheries in the American West. Pei-Lin Yu (editor). University of Utah Press. <http://www.csus.edu/faculty/s/stevensm/docs/fire-floodplains-and-fish-chapter6.pdf>

¹¹ Milligan, Brett and Alejo Kraus-Polk. 2016. *Human Use of Restored and Naturalized Delta Landscapes*. Report of the Watershed Center, UC Davis.

that people are a part of the landscape and that an understanding of human uses can lead to better landscape outcomes. The study pays attention to people’s attitudes and preferences as well. The authors, working closely with habitat restoration researchers, acknowledge that some uses are ecologically damaging, but they also recognize that the costs of enforcing regulations can be high. In some cases, it may be better to work with and develop people’s understandings to achieve better outcomes. Users of Delta landscapes can also be part of the environmental monitoring process. Milligan and Kraus-Polk conclude that human uses need to be factored into management of Delta landscapes, both existing and in the design of new restorations, to enhance the likelihood of achieving desired outcomes. This project is an example of research that couples some of the dynamics of human and natural systems.

Evading Dam-Nation: Land Use History of the Lower Cosumnes River Watershed

Michelaina Johnson, a graduating senior at University of California, Berkeley, prepared a history of the floodplains of the Cosumnes River¹². The Cosumnes is the only river of the 20 that drain the western Sierra Nevada and eventually flow into the Delta that is free of large dams, leaving its flow “natural” as it enters the eastern edge of the Delta. Ms. Johnson documents the early indigenous management of the floodplain and the subsequent diking and draining by settlers in the late 19th century. From extensive archival research and interviews with 20 people, including a key founder of the Cosumnes River Preserve, restoration ecologists, and local ranchers and farmers, Ms. Johnson demonstrates how the river’s unregulated flooding unintentionally enabled the preservation of some of the best examples of native habitat remaining in California, including the state’s largest oak riparian forest. Her thesis emphasizes the compatibility of flooding and certain types of agriculture with native habitat restoration and endangered species protection. Her epilogue emphasizes the challenges of climate change, increasing urbanization, and the planting of less wildlife friendly crops adjacent to the Cosumnes River Preserve, which protects the lower Cosumnes River watershed today.



The Cosumnes River’s unregulated flooding unintentionally enabled the preservation of some of the best examples of native habitat remaining in California

Synthesis Opportunities

Findings from research on the values of the Delta as an evolving place should inform many Delta decisions. We also note that two projects mandated by the 2009 Delta Reform Act provide excellent venues for aggregating and

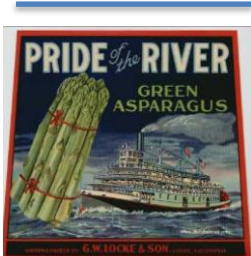
¹² Johnson, Michelaina. 2017. *Evading Dam-Nation: Land Use History of the Lower Cosumnes River Watershed* Senior Thesis, History. UC Berkeley.

<http://www.cosumnes.org/wp-content/uploads/2017/06/Evading-Damnation-Thesis-Johnson-2017.pdf>

synthesizing primary research on the Delta as an evolving place.

Delta Economic Sustainability Plan

The DPC commissioned a Delta Economic Sustainability Plan (ESP) as mandated by the Delta Reform Act of 2009¹³. Consultants prepared a draft for review and the final version was issued in early October 2011. The ESP addresses the contribution of cultural, recreational, natural, and agricultural resources to the Delta economy and how their sustainability can be assured¹⁴. We also note that the Public Policy Institute of California prepared a report in 2012 on the changing Delta economy suggesting a somewhat different future¹⁵.



The Delta Protection Commission is currently updating its 2011 Delta Economic Sustainability Plan

The DPC is currently updating the Economic Sustainability Plan. In our judgment, this updating of the ESP has considerable potential to improve understanding of the Delta's values as an evolving place within an economic framework.

Delta Levees Investment Strategy

The 2009 Act directs the Delta Stewardship Council to lead a multi-agency program to set priorities for State spending on Delta levees¹⁶. The resulting Delta Levees Investment Strategy (DLIS)¹⁷ would base spending priorities, in part, on estimates of assets that the levees protect, including Delta agriculture, Delta historical places, and water supplies to the Delta and beyond. The DLIS has assembled, island by island and tract by tract, underlying information on the broad factors contributing to the benefits of reducing risk of levee failure on individual islands.

This Delta-wide effort provides opportunities to incorporate and synthesize primary source data on Delta values, and on the processes that need to be protected and enhanced as the DLIS is updated. The effort includes identifying gaps that additional research on the Delta as an Evolving Place could help fill.

¹³ https://www.delta.ca.gov/regional_economy/economic_sustainability/

¹⁴ The Delta Science Program organized an [independent review of the draft of the ESP](#), and the review was released in December 2011. While lauding the report for assembling extensive pertinent economic information about the Delta, the reviewers expressed concern that the ESP made arguments with respect to the viability of the Delta's agricultural economy and the economics of water conveyance that were based on levee resilience to earthquakes and flooding that were not adequately documented. The timing of the [Independent Panel Review of the Economic Sustainability Plan for the Sacramento-San Joaquin Delta](#) meant that few of the panel comments affected the final draft of the Economic Sustainability Plan that was released in January 2012.

¹⁵ Medellín-Azuara, J., E. Hanak, R. Howitt, and J. Lund. 2012. [Transitions for the Delta Economy](#). Public Policy Institute of California, San Francisco, CA, 62 pp.

¹⁶ http://deltacouncil.ca.gov/sites/default/files/2015/01/15-0109_Levee_Investment_Strategy_Issue_Paper.pdf

¹⁷ <http://deltacouncil.ca.gov/docs/risk-analysis-methodology-revised-august-2016-final>

Recommendations

These recent advances notwithstanding, decisions about human use of the Delta and its waters require far greater understanding of the values listed in the Delta Reform Act and of the social and natural processes that underlie them. Chuck Bonham, Director of California’s Department of Fish and Wildlife, argued that Delta policy makers and managers were sorely in need of a better sense of the Delta as an evolving place:

‘How do you exactly define sense of place? I’m sure there’s an anthropological element, a psychological one, a sociological one, a historical one, and a geographical one. But I’m absolutely convinced that sense of place rests on passion. Some arrangement that’s a commitment to you to someplace that matters to you for some reason. We won’t do what needs to be done in the Delta in a void that lacks a sense of place. You may have it; most of Californians don’t, and that’s a problem.’

Charlton Bonham, Director
California Department of Fish & Wildlife
Keynote Speech, 13th Annual California Water Law Symposium
University of San Francisco January 21, 2017

The Delta and its waters require far greater understanding of the values listed in the Delta Reform Act and of the social and natural processes that underlie them

Accordingly,

We recommend establishing an ongoing research program on the Delta as an evolving place. We recommend that this area of research become substantial and integrated with Delta research in other areas such as flows, water quality, or at risk populations.

By research program we mean the organized accumulation of work by academics, nongovernmental organizations, and agency researchers that contributes to a recognizable literature that informs subsequent research, responds to new developments, contributes to coherent usable knowledge, and informs policy and management decision-making. Such a research area needs to evolve through the efforts of multiple funders and individual researchers and build to a coherent whole through further reviews over time.

We offer some specific suggestions.

1. The number of social scientists doing research on the Delta as an evolving place needs to be increased significantly to help balance research on the Delta environment.
2. Researchers in the humanities can contribute more to cultural and historical knowledge and the understanding of the Delta’s cultural, recreational,



Little has been established about the unique values of Sacramento-San Joaquin Delta as an evolving place and the social and environmental processes supporting those values

natural resource, and agricultural values. The Delta Narratives Project provides an excellent example with respect to cultural values.

3. Natural scientists currently researching Delta ecological questions can expand their work to help identify natural processes that protect and could be manipulated to enhance the values of the Delta as an evolving place¹⁸. In some cases, existing research findings may simply need to be interpreted with respect to how they relate to Delta values.
4. Coupled human-natural systems research can contribute to a systemic and dynamic understanding of the Delta as an evolving place. Research frameworks that incorporate feedbacks between human and natural systems are key to understanding the Anthropocene.
5. Citizen-science should be explored and expanded for identifying, monitoring, and valuing unique Delta qualities. Residents can assist in envisioning and assessing alternative Delta futures.
6. Research involving Native Californians who have lived in and/or used the Delta is critical for understanding the Delta's environmental and cultural history. Traditional Ecological Knowledge has much to contribute to our understanding of sustainability and possible Delta futures.

In addition to considering possible approaches and undertaking research on Delta as an evolving place (*e.g.*, particular topics suggested above), funders and researchers should give priority to projects that:

1. improve understanding of the natural and social processes that protect and could be used to enhance the values of the Delta as an evolving place,
2. are directed at reducing the greatest uncertainties in understanding, and
3. are designed and undertaken to inform near-term Delta decisions and/or those that may arise as the Delta continues to evolve.

Conclusion

Little has been established about the unique values of Sacramento-San Joaquin Delta as an evolving place and the social and environmental processes supporting those values. Research in this area is sorely needed if those values are to be protected and enhanced as decisions are made to meet the co-equal goals of reliable water supplies and restored ecosystems.

¹⁸ See, for example: Medellin-Azuara, J., E. Hanak, R.E. Howitt, Fleenor, W.E., and J.R. Lund. 2014. [Agricultural Losses from Salinity in California's Sacramento-San Joaquin Delta](#). San Francisco Estuary and Watershed Science, Vol. 12, No. 1.

Acknowledgments

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