

DRAFT:

Nature-Based Solutions for the Delta:

A Prospectus for an Independent Science Board Review

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disb@deltacouncil.ca.gov

All links in this prospectus have been created with meaningful text. If you have a printed version of this document, you can find the electronic copy of the prospectus on the [Delta ISB meetings webpage](#) for the October 2026 meeting:
<https://deltacouncil.ca.gov/delta-isb/meetings>

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Objective

Nature-based solutions (NBS) encompass a broad range of landscape actions that work with natural processes to address numerous societal challenges and is a philosophy that has been embraced globally by governments and in California through the leadership of the California Natural Resources Agency. Recent global reviews of scientific research informing NBS implementation¹²³ indicate that this

¹ Echebarria, C. and I. Gomez de Salazar, 2026. Bibliometric and literature review of research on nature-based solutions and climate change: Implications for policy and practice. *Ambio*. 55. 689-773

² Adarsh T., and Haneena Sulthana K.P. (2025). Trends and insights in Nature-Based Solutions: A bibliometric study. *Int. J. Disast. Studies Climate Resil.* 1(1):22–34.

³ Paxton A.B. et al., 2024. Evidence on the performance of nature-based solutions interventions for coastal protection in biogenic, shallow ecosystems: a systematic map. *Environmental Evidence*. Springer. 13:28. p 1-32.

rapidly evolving field is achieving significant benefits but lacks engineering standards, common best practices, mechanisms for rapidly sharing new knowledge and common approaches for effective application of adaptive management. To address this issue, this review by the Delta Independent Science Board (ISB) will develop a categorization of NBS as applied to the Sacramento-San Joaquin Delta and explore the range of actions and performance evaluations conducted, including adaptive management triggers. The review will identify common barriers that impede and innovations that expedite success. The goal of having an NBS categorization is to improve the efficiency of decision making by clarifying what types of models, data, and resources are most appropriate for different project contexts and helping the community evaluate what is feasible, beneficial, and scalable within the Delta's complex social ecological landscape.

Motivation

In this era of long-term warming, sea-level rise, more intense and frequent storm events, severe droughts and overall increased climatic variability and uncertainty, projects must be designed to be robust and adaptable to this new reality. There is a deep commitment across California and within many other jurisdictions to work with natural processes to reduce risk to communities and infrastructure while sustaining economic growth, ecological function, and cultural resources. This philosophy simultaneously addresses the unknowns of climate change, loss of biodiversity and recovery of landscapes with cultural or ecosystem value.

California has an extensive history of implementing innovative NBS over the past 50 years with numerous projects distributed across San Francisco Bay, the Sacramento-San Joaquin Delta, the Suisun Marsh, and the watershed.

NBS is defined in broad terms by the California Natural Resources Agency's [Natural Working Lands Climate Strategy](#) as:

“actions that work with and enhance nature to help address societal challenges. This term is an umbrella concept being used across the world to describe a range of approaches that protect, sustainably manage, and restore nature to deliver multiple outcomes, including addressing climate change, improving public health, increasing equity, and protecting biodiversity.”

This definition encompasses a comprehensive array of management actions in urban, agricultural, and natural landscapes. As the urgency of both climate change and loss of biodiversity have become apparent across the world, California has elevated NBS through a multi-billion dollar investment in landscape-scale NBS initiatives as described in the [2025 Progress Report: Nature-Based Solutions Targets](#), including the [Tribal Nature-Based Solutions Program](#). These initiatives are supported by a deep bench of scientific and engineering expertise across agencies, local governments, Tribes, non-governmental organizations, universities, consultants, and the private sector.

NBS can deliver a wide range of benefits, including flood risk reduction, reduced shoreline erosion, habitat creation, greenhouse gas mitigation, carbon sequestration, and new recreational opportunities. NBS often generate multiple co-benefits beyond their primary purpose. For example, wetland restoration and rice cultivation can slow or even reverse subsidence in parts of the Delta while also providing co-benefits like sequestering carbon, restoring habitat, and creating potential economic opportunities for farmers transitioning to rice production.

This review by the Delta ISB considers NBS in relation to the management of the Delta and the implementation of the [Delta Stewardship Council's Delta Plan](#) as well as the [Science Action Agenda](#), which explicitly identifies nature-based solutions in Management Action 6d.⁴ In addition to NBS projects conducted within the Delta boundaries, many actions taken in San Francisco Bay and the watershed contribute direct or indirect benefits to the management of the Delta as well as California water writ-large.

There is an accelerating interest in NBS across the United States and internationally with many significant scientific and technological advances. NBS projects are proceeding at pace to support climate mitigation and adaptation strategies, but also to contribute to ecological recovery and numerous other societal benefits. NBS is a rapidly evolving field and many actions have a significant time lag before full benefits are achieved and demonstrated. Therefore, the implementation of NBS does not always incorporate shared lessons learned or best available practices –

⁴ Management Action 6D: Identify how human communities connected to the Delta watershed are adapting to climate change, what opportunities and tradeoffs exist for climate adaptation approaches (i.e., agricultural practices, carbon sequestration, nature-based solutions/green infrastructure), and how behaviors vary with adaptive capacity.

resulting in missed opportunities to further enhance benefits or reduce risks of not attaining project objectives. Moreover, some hesitation toward NBS approaches is understandable given limited familiarity and uneven performance data, but other reluctance reflects longstanding defaults to engineered solutions and can be addressed through clearer evidence, demonstration projects, and transparent risk communication.

A review by the Delta ISB can identify what other regions can learn from the Delta, and vice versa. This Delta ISB review will:

1. Provide a high-level summary of what is meant by NBS within the context of the Delta Plan in particular and what type of NBS are being planned or implemented in the Delta.
2. Explain the role of science, Traditional Knowledge, and adaptive management in (a) defining and demonstrating benefits associated with NBS, and (b) selecting NBS over engineering 'gray' infrastructure.

This review will not attempt to provide a comprehensive inventory of all NBS projects within the Delta, but rather provide a categorization of all types of NBS that benefit the coequal goals and sustain the culture and communities of the Delta. This categorization will include the landscape feature, the primary objective of the project, any associated co-benefits, primary project implementor(s), funding source, adaptive management triggers, and the expected timescale for realizing benefits. This synthesis will examine why and when projects choose to use nature-based solutions, how their performance is evaluated and the critical elements of performance assessment, and highlight partnerships and innovations in science, engineering, and co-funding that could inform and support others pursuing similar efforts.

Intended Audience

The Delta ISB envisions a multi-phase review with this prospectus focused on the first phase. This initial review is intended to develop an overview reference document for NBS in the Delta and may be the foundation for future reviews by the Delta ISB on specific aspects of NBS, depending on feedback from agencies, Tribes, NGOs and other experts during this review. By providing an accessible overview of NBS types, scientific considerations, and performance assessment methods, the

goal of having a NBS categorization is to improve the efficiency of decision making by clarifying what types of models, data, and resources are most appropriate for different project contexts and helping the community evaluate what is feasible, beneficial, and scalable within the Delta's complex social ecological landscape.

Inputs to the Review (Methods)

The review will employ the following methods:

1. **Capture a more nuanced definition of NBS** as it pertains to the Delta as well as influences from Bay and upstream portions of the watershed. This definition will be developed from considering definitions applied to other NBS initiatives in the US and internationally as well as ideas used in agencies or the scientific community within California. The types of NBS in the Bay-Delta watershed that have or are likely to accrue significant benefits to the Delta will be included, although the scope of this prospectus will not account for all NBS outside the Delta region.
2. **Compile a categorization under this NBS definition.** Specific actions conducted within the Delta will be categorized with actions gleaned from multiple sources, including: Eco-Atlas, Delta Science Tracker, the 2026 California Natural Resources Agency's Nature-based Solutions Summit series, the Tribal Nature-based Solutions Program, Delta Plan covered actions, and published literature. If needed, this review of published and online information will be supplemented by a survey of relevant agencies, Tribes and other entities to gather information not available through published sources with care taken to minimize workload and any duplication among partners.
3. **Host a series of panels on NBS** to inform the categorization of NBS actions.
 - a. The Delta ISB held the first [panel discussion in May 2026](#) with State agency leaders to identify their scientific challenges and needs that the Delta ISB can help with, such as the uncertainty associated with measuring multiple co-benefits and identifying adaptive management triggers for large-scale projects. This discussion helped inform the scope of the prospectus. The first panel also highlighted how different State agencies defined NBS, where this term was not commonly used by some agencies.

- b. The second panel at the [Bay-Delta Science Conference](#) in September 2026 will examine how organizations within and beyond California apply NBS to achieve multiple co-benefits, and how adaptive management triggers and actions can be identified at scale, which were key challenges highlighted during the May discussion.
 - c. The Delta ISB will hold additional panels, as needed, to inform the effort and gather perspectives not readily available online.
- 4. **Synthesize information about each type of action** including the primary objective, co-benefits, primary project proponent and key partners, funding sources, adaptive management and monitoring plans, elements of performance assessment, management-relevant uncertainties, and typical timelines to achieve benefits.
 - 5. **Solicit and incorporate community feedback.** There will be plenty of opportunities for the public to provide feedback, including at Delta ISB meetings and written comments on draft materials.

Barriers encountered to implement each type of action will be documented as well as opportunities and ideas for science that could support efforts to accelerate implementation. Specifically, consideration will be given to when NBS is used, the role of monitoring and performance assessment (and how it is funded) to demonstrate whether expected project benefits are achieved, and the appropriate timescale for the assessments. Examples will be documented that could encourage similar projects and foster collaboration between different entities pursuing NBS innovations.

Deliverables

- 1. A **brochure** explaining NBS and what it means to the Delta.
- 2. Peer-reviewed **journal article** of the main findings, which will include a categorization of NBS relevant to the Delta and its watershed. It is anticipated that the article will highlight the long history of NBS in the Delta as well as innovations being implemented or planned.

Timeline

The precise timeline will be dependent on feedback from public comments, but the goal is to have the first product within 12 months from the finalization of the draft prospectus. Whether the brochure or peer review journal article will come first, will depend on the outcome of the categorization of NBS projects.

Task	Targeted Timeframe
Panel #1: Perspectives with State agencies to inform the scope of the review	May 2026
Panel #2: Cross-system learning at Bay-Delta Science Conference	September 2026
Additional panels and initiate survey of key agencies and Tribes (if needed)	Early 2027
Research NBS definitions and develop one for the Delta ISB review	February 2027
Compile categorization of NBS projects and develop one for the Delta	June 2027
Synthesize and prepare manuscript for Delta ISB and public discussion	September 2027
Submit paper for peer review publication	December 2027
Work on brochure	Early 2028

Previous Reviews and Relevant Efforts

The Delta ISB is in the process of completing a review on subsidence and previously completed a [restoration review \(2013\)](#), which includes projects that can be categorized as NBS. In addition, the Delta ISB is aware of the following efforts and will coordinate accordingly to ensure this review does not duplicate work:

- Nature-based Solutions Summit:** On January 29, 2026, the California Natural Resources Agency, with support from Trust for Public Land, hosted California's first [NBS summit](#). The summit brought together a diverse group of leaders to share experiences, provide insights, and guide next steps. The California Natural Resources Agency is keeping the conversation going with [eight-landscape scale-specific NBS summits](#) through 2026.

- **Tribal Nature-Based Solutions Program:** The California Natural Resources Agency established the [Tribal Nature-Based Solutions \(TNBS\) Program](#) in response to feedback received from California Native American Tribes during the tribal consultations on Governor Newsom's Executive Order N-82-20 (Nature-Based Solutions Executive Order), the Pathways to 30x30 Strategy, and Natural and Working Lands Climate Smart Strategy. The Tribal Nature-Based Solutions Program and grant funds are part of this commitment to partner with California Native American Tribes in advancing multi-benefit NBS priorities for their communities.
- **Symposium - Accounting for Blue Carbon in the Bay-Delta: Science, Policy, and Practice:** UC Davis and the Delta Science Program hosted a [symposium in March 2026](#) that convened leading scientists, policymakers, land managers, and other interested parties to explore the science and policy of blue carbon. The event highlighted recent research on carbon dynamics across land-sea interfaces, identified key habitats and conditions that optimize carbon sequestration, and evaluated frameworks for carbon and greenhouse gas accounting and integration with climate policy.
- **[2025 Progress Report: Nature-Based Solutions Climate Targets](#):** As called for in Assembly Bill 1757 (2022), the California Natural Resources Agency, the California Air Resources Board, the California Environmental Protection Agency, the California Department of Food and Agriculture, and more than 40 State agency partners collaborated to develop NBS climate targets for 2030, 2038, and 2045 that contribute to California's goals of achieving carbon neutrality no later than 2045.
- **[Delta Data Synthesis Working Group](#):** The Delta Science Program is partnering with the National Center for Ecological Analysis and Synthesis (NCEAS) to lead collaborative data synthesis working groups focused on topics of management concern.
 - One of the topics for the 2026 cohort is on carbon. Inspired in large part by California's Natural Working Lands Climate Smart Strategy and awareness of the critical role that land management can play in GHG emissions and potential carbon sequestration, the carbon working group has goals to improve soil carbon data accessibility for private landowners and land managers working in the Delta region.

- The 2023 cohort focused on assessing multi-benefit approaches to managing the Delta as a social-ecological system and investigating the integration of human dimension data into research and management decision-making. Two subgroups from this working group are evaluating the following research topics:
 - How ecosystem restoration projects benefit and burden human communities, with an emphasis on environmental justice.
 - The social, economic, and ecological costs and benefits of levee infrastructure within the Delta.
- **Multi-Benefit Wetland Restoration in the California Bay-Delta: A Governance and Policy Process Perspective:** Dr. Kyra Gmoser-Daskalakis recently completed a [dissertation](#) that explored investment choices and implementation barriers of project partners to understand wetland restoration as a social-ecological process. Key findings include:
 - Most often, benefits are not achieved in projects due to conflicts with other benefits (e.g., managed wetlands and ponds serve different species than tidal wetlands).
 - Physical site conditions (e.g., utilities, ecological conditions) often prevent certain benefits.
 - Permit conditions may not consider site-level differences and create challenges for project partners.
- **Delta Carbon Team:** The Sacramento-San Joaquin Delta Conservancy and The Nature Conservancy convene this interdisciplinary group of scientists and land managers who are invested in advancing carbon research, data accessibility, management, funding, and policy in the Delta. This team was formed in part to address recommendations coming out of the Delta ISB's subsidence review.
- **Other Venues:** The Delta ISB will also track developments related to NBS arising from the [Delta Climate Adaptation Team](#) and the [Delta Plan Interagency Implementation Committee Restoration Subcommittee](#).