NOV 2025

Draft Delta Science Plan

Strengthening Science in the Sacramento-San Joaquin Delta

2026

Delta Science Program

DELTA STEWARDSHIP COUNCIL

Table of Contents

Letter from the Delta lead scientist

As we prepare for the release of the 2026 Delta Science Plan, we find ourselves in interesting times. Little did we know how "grand" our challenges would become when the first work began in 2021 on scoping this forward-looking science plan. Of recent concern, we've begun to feel a perceived skepticism of the foundational value of science, despite science being our very best tool to adapt to known and unknown forces. Growing science along with growing scientists has become a challenge, even as we seek to improve relevance and representation in the science enterprise. But science, as a way of knowing, is as powerful as ever, and we should raise our voices in its effective use and communication.

Science is powerful because it is inherently hopeful, inherently optimistic. Science is a progression of lights that guides us in an increasingly uncertain future, illuminating paths and voids. We succeed in growing science when we light a fire through education and communication, and when we support keepers of the flame. We succeed in protecting science when we value this lighthouse we have built, and we succeed in accelerating science when we identify a north star to collectively point to, so we can go farther and faster together.

That is our goal here in the updated Delta Science Plan – to provide a collective platform for this creative and effective science enterprise to use in launching discoveries within an ever-growing solution space. Those discoveries are key to addressing the ever-growing resource and representational challenges of the Sacramento-San Joaquin Delta. From my leadership vantage point, I can see an extensive network of leaders throughout this passionate community, all suggesting practical and aspirational actions that are collectively represented in this collaborative science plan. Together, we are building a relevant and resilient science for a changing world, a science that is able to adapt and grow to be more effective through interweaving disciplines and ways of knowing. And I can see it because I am standing on our community's shoulders, your shoulders, the true shoulders of giants. I am eternally grateful for this view, as even more light can be seen on the horizon.

The Delta Science Plan provides the vision, principles, and approaches for coordinating, conducting, and communicating science in the Delta. Each action plays a part in helping us to address our grand challenges, but some especially relevant actions that I want to highlight are:

- Action 1.6 **Building stronger science and management goal alignment** → Everyone loves a cool science story, but we as a community need to also share the love for science that moves the needle on management decisions. The stakes are too high for the risks facing us in terms of reliable water supplies, ecosystem sustainability, and cultural preservation. Aligning research questions and timeframes and settings with actual agency and economic pivot points makes research efforts imminently more useful and impactful.
- Action 2.3 **Support scenario-based models that allow us to test management interventions that consider radically different future conditions for more informed, future-looking decision making** → Delta actions, and inactions, are so interwoven that not exploring future scenarios, even when they are unlikely or when they are expected to lead to undesired outcomes, leaves us poised for unpleasant surprises. From conceptual to numerical to advanced statistical approaches, we have many powerful modeling tools to explore decision optimization, and we should not be afraid to use them.
- Action 3.3 **Increase research coordination at the watershed and estuary scale through systems thinking** → Systems thinking, and its search for integration of landscape and societal components, allows us to fully embrace the tools and opportunities we have to respond to resource management. Coastal and upland drivers dance together in the Delta, leading and lagging in different ways, in different places, and increasingly through extreme events. Collaborations across the land-ocean aquatic continuum, as well as the model approach continuum, accelerate a nimble and more robust understanding of our integrated system and its interwoven feedback.
- Action 4.4 **Build trust through intentional and reciprocal working relationships** → Our shared knowledge – whether gained through institutional, ancestral, or lived experience – is our primary toolbox, and true sharing takes trust. We can build that trust through intentionally seeking the missing or quiet voices in our community that hit the high notes and harmonics when most of us are circling around a central tendency. It is a richness we have available to us if we are only brave enough to see it.

While our steps may be small, all these intentional actions are essential to addressing our grand challenges. And in some ways, we are light-years ahead of other regions in addressing similar challenges. Over these push and pull years, one thing we have learned, as a Delta science community, is the lesson of partnership and transparency as fundamental to innovation and insight. The potential and

practice of science is rarely advanced alone, and I sincerely hope we never choose singular paths again. For all our challenges, Delta science today reflects a commitment to community discovery and governance that radiates far beyond the three corners of the Delta: Freeport, Vernalis, and Suisun. May we keep that hard-won perspective and send strength where and when it is needed, to meet our resource challenges of tomorrow.

– Delta Lead Scientist Dr. Lisamarie Windham-Myers

Acknowledgements

This document would not be possible without the energy and enthusiasm provided by the Delta science community, including a broad range of agency staff and interested parties. Special thanks to the many participants of the February 2025 public workshop for their time and thoughtful insights, and to the Delta Stewardship Council's Delta Science Program staff for their contributions throughout the process.

Unless otherwise noted, all photographs are courtesy of the California Department of Water Resources.

Suggested citation

Delta Stewardship Council, Delta Science Program. 2026. Delta Science Plan: Vision, principles, and approaches for integrating and coordinating science in the Delta.

Executive summary

The 2026 Delta Science Plan includes 24 actions that collectively strive to tackle four "grand challenges" in Delta science. Like past iterations, the Delta Science Plan is called for in the Delta Plan and aims to strengthen the *doing* of science across the Delta. Ultimately, the goal of the Delta Science Plan is to better inform the management and advancement of the State's coequal goals for the Delta of providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem, in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place (Cal. Wat. Code 85054.).

Figure 1. *The four grand challenges facing the Delta are not independent but rather*

overlapping and interconnected issues that will require collaborative and interdisciplinary intervention. ***This image is subject to change***

Each action features an associated example (referred to as “Current Momentum”) to showcase existing or planned initiatives that are making progress in addressing the action, while encouraging new connections and inspiration for future work.

The 2026 Delta Science Plan continues to advance priorities such as adaptive management, science communication, scientific peer review, and science funding, while also expanding on themes related to social science, governance, and Traditional Knowledge. These three themes are considered priority tools for tackling the four grand challenges by the Delta science community.

Table 1. Summary of actions within each grand challenge and their corresponding theme.

	Monitoring	Modeling & Experimentation	Data Accessibility	Collaboration & Communication	Synthesis & Review	Funding	Governance & Relationships
Grand challenge 1: Scientists and managers must anticipate a world in which environmental conditions and regulations may be fundamentally different from those faced today							
ACTION 1.1: Support the ongoing shift from single species to holistic monitoring and management of ecosystems	X						
ACTION 1.2: Support horizon scanning to detect and understand emerging signals		X					
ACTION 1.3: Strengthen links between models and data for more streamlined and informed decision-making		X					
ACTION 1.4: Focus on regional resilience to climate change		X					
ACTION 1.5: Improve connectivity between executive, management, and staff/scientist levels				X			
ACTION 1.6: Build stronger science and management goal alignment					X		

Table 1. cont.

	Monitoring	Modeling & Experimentation	Data Accessibility	Collaboration & Communication	Synthesis & Review	Funding	Governance & Relationships
Grand challenge 2: Environmental change is outpacing the traditional pace of science							
ACTION 2.1: Expand adaptive monitoring and management	X						
ACTION 2.2: Invest in enhanced tools and expertise in cutting-edge technology to anticipate near-future conditions	X						
ACTION 2.3: Support scenario-based models that allow us to test management interventions that consider radically different future conditions		X					
ACTION 2.4: Support actions to cut green tape and streamline decision-making practices				X			
ACTION 2.5: Investigate mechanisms of sharing information more efficiently and effectively					X		
ACTION 2.6: Implement more responsive and targeted funding structures						X	

Table 1. cont.

	Monitoring	Modeling & Experimentation	Data Accessibility	Collaboration & Communication	Synthesis & Review	Funding	Governance & Relationships
Grand challenge 3: Flows of scientific information remain decentralized and poorly connected to communities and decision-makers							
ACTION 3.1: Support free and open data			X				
ACTION 3.2: Support collaborative venues for efficient flow of information				X			
ACTION 3.3: Increase research coordination at the watershed and estuary scale through systems thinking				X			
ACTION 3.4: Improve social science literacy				X			
ACTION 3.5: Use social science data and disciplines to inform management decisions				X			
ACTION 3.6: Proactively identify opportunities to leverage independent scientific peer review processes to enhance the scientific rigor, transparency, and credibility of science underpinning management and policy decisions					X		
ACTION 3.7: Increase funding opportunities and capacity for social science research and collaborations						X	

Table 1. cont.

	Monitoring	Modeling & Experimentation	Data Accessibility	Collaboration & Communication	Synthesis & Review	Funding	Governance & Relationships
Grand challenge 4: Other ways of knowing, especially Traditional Knowledge, remain siloed from decision-making.							
ACTION 4.1: Respect tribal data ownership and confidentiality			X				
ACTION 4.2: Support more co-produced and community-engaged science				X			
ACTION 4.3: Explore ways to expand funding for research that engages community and tribal expertise						X	
ACTION 4.4: Build trust through intentional and reciprocal working relationships							X
ACTION 4.5: Embrace more ways of knowing							X

In addition to the 24 actions outlined above, the 2026 Delta Science Plan also includes six Resources (formerly Appendices) that have been updated from the 2019 iteration to reflect our current practices and progress better. These Resources provide practical and useful information for the Delta science community and are responsive to the actions within the Delta Science Plan. In addition to the six that were updated, there are two new additions:

1. **Resource A:** *Data governance, portals, and online resources*
2. **Resource B:** *Making science whole: Embedding social science in natural science workflows*

The Delta Science Plan is supported by the broad Delta science community and was developed through a transparent, open, and inclusive process (see Appendix B: *Process to update the Delta Science Plan*). The actions outlined in this updated Delta Science Plan must be collectively implemented to produce and communicate credible, relevant, and legitimate science that supports effective and robust management actions. We encourage members of the Delta science community to utilize the actions and tools outlined in this document to guide and strengthen their own efforts toward a more connected, collaborative, and resilient Delta.

The Delta Science Plan: What it is and why we need it

There are few places in the world with the ecological, economic, cultural, and political significance of the Delta. The region supports a diverse array of complex ecosystems, is home to many threatened and endangered species, is a recognized National Heritage Area, and is a place of residence and importance to human communities and tribes, both currently and historically (Luoma et al., 2015). The Delta also provides water for approximately 27 million people and supports a substantial agricultural economy (Delta Conservancy, 2025). However, over the last century and a half, the Delta has undergone significant transformations due to large-scale changes in water routing, the introduction of non-native species, land use alterations, climate change impacts, and other factors. These changes have made the Delta ecosystem vulnerable to numerous threats, including floods and long-term droughts (Hartman et al., 2025). There is a shared sense of urgency to take action to protect and manage the Delta's resources. To help organize science activities in the Delta, the Delta Science Plan provides the framework for conducting, coordinating, and communicating science to support this vital region.

The Sacramento-San Joaquin Delta Reform Act of 2009 (Delta Reform Act) and the coequal goals

The Delta Reform Act (California Water Code § 85000 et seq.) created in state government the Delta Stewardship Council as an independent agency of the state to "develop, adopt, and commence implementation of the Delta Plan… that furthers the coequal goals." (Cal. Wat. Code §§ 85200(a) and 85300(a)). "'Coequal goals' means the two goals of

[1.] providing a more reliable water supply for California and

[2.] protecting, restoring, and enhancing the Delta ecosystem.

The coequal goals 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," (Cal. Wat. Code § 85054).

What is the Delta Science Plan?

The importance of science-informed decision-making has been widely recognized in the Delta (Colombano et al., 2025) and was legally mandated with the passage of the Delta Reform Act, which established California's coequal goals for managing the

Delta and created the Delta Stewardship Council to adopt and implement the Delta Plan, a comprehensive, long-term management plan for the Delta. (Cal. Wat. Code §§ 85084, 85059, and 585302(g)). One of the recommendations in the Delta Plan is the development of the Delta Science Plan (The Delta Plan, G R1. Development of a Delta Science Plan).

The Delta Science Plan, produced by the Delta Stewardship Council's Delta Science Program, provides the vision, principles, and approaches for conducting, coordinating, and communicating science in the Delta. Developed through extensive engagement with the Delta science community, the Delta Science Plan represents a shared commitment to improving how science is done and used in the region. We encourage members of the Delta science community to use the actions and tools provided in this document to guide and strengthen efforts for a more connected, collaborative, and resilient Delta. The Delta Science Plan is also the first element of the three-part Delta Science Strategy (see*: One Delta, One Science and the Delta Science Strategy*).

Since its first release in 2013, the Delta Science Plan has been updated approximately every five years (in 2019 and now 2026) to reflect emerging concepts, evolving management needs, and new opportunities for action (see Appendix A: *Implementation Successes: Status of 2019 Science Plan and Relevant Outcomes* for a detailed review of progress made on the 2019 Delta Science Plan actions). While the Delta Science Plan helps inform priorities within the Delta Science program, the broader intent is to catalyze science activities across the Delta and better coordinate an open Delta science community. We invite agencies and organizations working in the Delta to leverage the Delta Science Plan, seek alignment with existing science planning efforts, and collaborate and coordinate resources to implement the Delta Science Plan's actions and resources.

Here, we define the Delta science community as any entity actively participating in science and management actions in the Delta, including federal, state, and local agency scientists, tribes, non-governmental organizations, academic researchers, and interested members of the public. Resource F: *Science governance and the collaborative Delta science-scape* provides an updated network analysis of the main collaborative science venues in the Delta and shows almost 200 organizations that participate in at least one of the 13 core venues identified in the analysis. This intended broad audience is reflected in the extensive engagement that has been central to this update process (see Appendix B: *Process to update the Delta Science Plan* for details).

The Sacramento-San Joaquin Delta

Background

The Delta provides the water supply for two-thirds of California's population and provides critical habitat and migratory pathways for a diverse set of species – many of which are threatened or endangered. The Delta is also an area of significance for tribes throughout the watershed that have stewarded these lands for time immemorial. A highly engineered mosaic of land uses, the Delta is home to roughly 600,000 residents and sustains a $32 billion agricultural industry. The Delta and its ecosystem are also at constant risk of catastrophic damage from climate change, sea-level rise, droughts, floods, earthquakes, invasive species, and other stressors. In this rapidly changing and intricately connected system, resource management in the Delta has been termed a "devilishly wicked problem" (Luoma et al., 2015).

Geographic significance

The Delta is situated at the confluence of the Sacramento and San Joaquin rivers. The region is central to the continuum of ecosystems and management issues connecting freshwater flows from the upper watershed to the larger estuarine system of the San Francisco Bay, and water supply systems conveying water to users in southern watersheds. However, given the complexity of the issues and the scope of the Delta Reform Act, the Delta Science Plan focuses primarily on the legal Delta and Suisun Marsh. However, it is important to note that tribes throughout the California region viewed and still view the entire watershed that runs from Mount Shasta to the Tulare Basin as one interconnected, culturally sacred system that cannot be demarcated into sections (heard in tribal pre-consultations prior to release of the public draft of the Tribal and Environmental Justice in the Sacramento-San Joaquin Delta paper) (Delta Stewardship Council, 2025).

Today's Delta

Challenges in the Delta have many dimensions (e.g., physical, social-economic, and ecological) and sometimes conflicting solutions. In a rapidly changing social-ecological landscape, addressing these challenges requires a high level of communication and coordination among scientists, engineers, communities, and decision-makers.

Figure 2. *The Delta Watershed and Areas Receiving Delta Water. Source: The Delta Plan Figure ES-1.*

Why we need a Delta Science Plan

A coordinated, science-based approach is essential for managing the Delta and Suisun Marsh to achieve the vision of One Delta, One Science and further the coequal goals in a manner that enhances and protects the Delta as an evolving place. The Delta already benefits from a strong foundation of high-quality science conducted by researchers across academic, local, state, and federal institutions. One of our grandest challenges now is ensuring that this science remains open, trustworthy, and anticipatory – designed to meet the pace and scale of environmental change that is already outpacing the traditional pace of science. The Delta Science Plan offers principles and approaches for advancing not only coordination and communication but also the integrity, transparency, and adaptability of science – ensuring that the collective knowledge of the Delta science community can guide decisions in an era of rapid change.

But, the challenge of effective science coordination remains paramount, particularly concerning major topics with wide-ranging and multifaceted impacts that span agency and geographic mandates like the grand challenges. In the Delta, insufficient direct and bidirectional flows of information between scientists and decision-makers have resulted in a disconnect that imposes barriers to adaptive governance and is detrimental to public trust in decision-making. Drafting each iteration of the Delta Science Plan provides an opportunity for us to work together as a community to identify tools and strategies that are relevant to current science and management needs. The updated Delta Science Plan that results from this collaboration serves as a catalyst for collective action to achieve progress towards a more unified and scientifically informed community.

One Delta, One Science, and the Delta Science Strategy

The vision of One Delta, One Science, refers to an open Delta science community that works together to build a common body of scientific knowledge. Achieving this vision requires a sustained culture of cooperation and stewardship among decision-makers, scientists, managers, interested parties, and the public.
Three guiding documents were developed to form the Delta Science Strategy and to help further the vision of One Delta, One Science. with the capacity to adapt and inform future water and environmental decisions and reduce disagreements influenced by conflicting interest. The Delta Science Plan, the State of Bay-Delta Science, and the Science Action Agenda (SAA) (Figure 3) each play a different role in promoting the use and understanding of collaborative science in the Delta.

The Delta Science Plan

The Delta Science Plan is the overarching document that identifies the tools, organizational structures, mechanisms, and actions needed to support a more collaborative and integrated Delta science community and is intended to be a shared framework for the Delta science community.

The State of Bay-Delta Science

The State of Bay-Delta Science is an ongoing synthesis and communication effort intended to inform science and policy audiences about the “state of the science” for topics relevant to managing the Bay-Delta system. It highlights progress made on key research questions and identifies remaining knowledge gaps. The State of Bay-Delta Science also provides context for the Delta Science Plan and guides updates to the SAA.

The Science Action Agenda

The Science Action Agenda identifies focused science actions to help achieve the objectives of the Delta Science Plan and to address key management questions. The science actions are specifically focused on filling gaps and promoting collaborative efforts. The SAA serves as the common agenda from which agencies and programs can develop more detailed, shorter-term work plans (e.g. the Interagency Ecological Program Annual Work Plan). Further, the priorities in the SAA guide funding decisions of the Delta Science Program and partner organizations.

All three guiding documents in the Delta Science Strategy are openly developed and updated based on input from the Delta science community, including the Delta Independent Science Board (Delta ISB), and information gathered from peer-reviewed literature, existing science plans, and synthesis reports. However, these documents alone cannot achieve the vision of One Delta One Science – the Delta science community must enthusiastically embrace and implement the concepts laid out to ensure science is used effectively to support natural resource management decisions. Additionally, collaborative science plans do not live in a vacuum. From federal to state to non-governmental organizations, individual agencies, with their own specific scope and missions, often develop targeted science strategies that benefit the larger Delta enterprise. Further, they give and take from larger collaborative efforts such as One Delta, One Science.

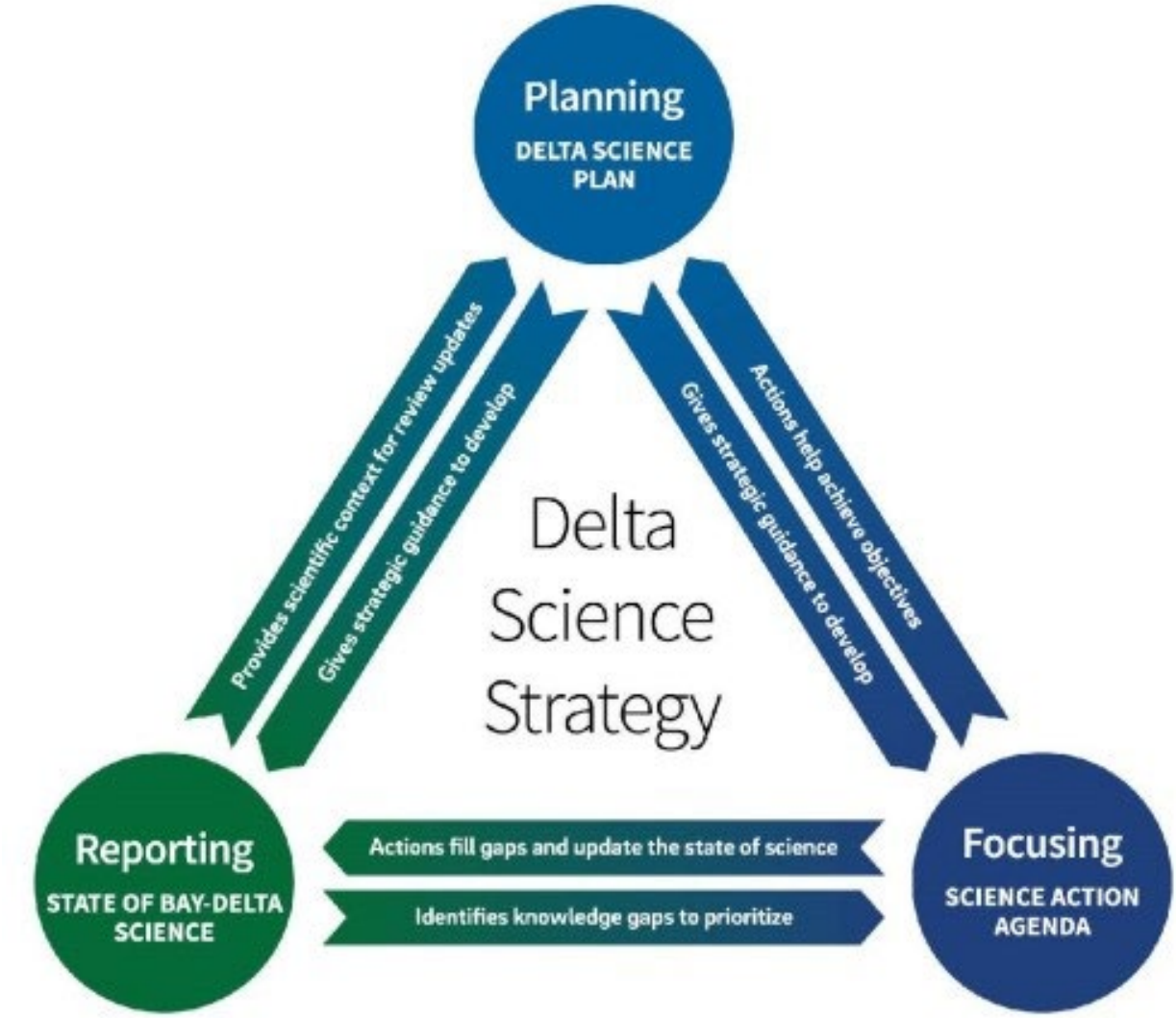


Figure 3. *The Delta Science Strategy. The three guidance documents that make up the Delta Science Strategy and the relationships among the three elements. These documents are formed openly and transparently based on input from the Delta science community, drawing from a variety of existing documents.*

Progress since 2019: What has been achieved so far?

The 2019 Delta Science Plan included a total of 26 actions that were organized around six objectives and four thematic chapters. Many of the previous actions built upon actions in the first Delta Science Plan (2013). There has been substantial progress towards achieving these objectives and some highlights from the last five years are provided below. For more details, see Appendix A: *Implementation Successes: Status of 2019 Science Plan and Relevant Outcomes,* which summarizes the status of each of the 26 actions from the 2019 Delta Science Plan.

Four Chapters

1. **Shared Mechanisms to Inform Policy and Management:** Calling for the creation and expansion of tools to support effective coordination and collaboration in the Delta science community, most progress was achieved by the creation of new online tracking tools, workshops, and trainings.
2. **Modernize, Integrate, and Build the Delta Science Infrastructure:** Many of the actions aiming to build science infrastructure saw progress and yielded completed products, especially those related to social science, monitoring evaluation, and open data resources.
3. **Support Effective Decision-Making Through Science-Based Adaptive Management and Decision Support Tools:** The actions yielded progress related to decision-making, for enhancing support for adaptive management and venues for sharing and discussing adaptive management resources and lessons learned.
4. **Collectively Support Implementation of The Delta Science Plan:** Most efforts to promote implementation of the Delta Science Plan were only initiated or ongoing, providing opportunities to build from with the 2026 Delta Science Plan.

How is this update different?

Structure

The actions in the 2019 Delta Science Plan were assigned a lead organization or agency ("Primary Responsibility") to steer implementation and other "Action Participants" to support. In contrast, the 2026 update contains 24 actions that are organized around the four grand challenges to Delta Science and seven cross-cutting themes providing a framework that emphasizes persistent system-wide issues, while making it easier to navigate for users seeking specific themes (e.g., monitoring). Each of the actions also has an associated example of ongoing efforts coined "current momentum". The current momentum sections within each action are meant to serve as illustrative examples of each action, highlighting areas for further investment, motivation, or collaboration. They are by no means a comprehensive review of ongoing or planned activities in the Delta.

Additionally, **the 2026 Delta Science Plan includes both Appendices and Resources**. While Appendices describe work to develop the current plan and the implementation progress from the previous plan, the Resources provide practical and useful information for the Delta science community and are responsive to the actions included within this plan. The intention is that these Resources will become stand-alone living documents that will be accessible online, outside of just the Delta Science Plan.

Themes

The 2026 Delta Science Plan continues to advance priorities such as adaptive management, science communication, scientific peer review, and science funding, but delves deeper into several additional topic areas. The following three themes – governance, social science, and Traditional Knowledge (other ways of knowing) – are considered priority tools for tackling the four grand challenges by the Delta science community, gleaned from feedback received during our public outreach process and the February 2025 Delta Science Plan Workshop.

Governance

This update addresses governance more directly. Flows of information and collaboration between entities in the Delta (such as agencies and collaborative groups) are highly networked, constituting a classic system of polycentric governance, discussed further within grand challenge 3. The decentralization of

Delta science is a persistent challenge, but it has seen vast progress in recent decades, with a shift toward increasing centrality but also increasing complexity. Grand challenge 3: *Flows of scientific information remain decentralized and poorly connected to communities and decision-makers*, highlights the Delta's polycentric governance system and proposes actions to strengthen communication and coordination across boundaries. Governance in the Delta is further discussed in Resource F: *Science governance and the collaborative Delta science-scape*.

Social sciences

A major shift in this update is a stronger focus on the social sciences. In settings like the Delta, where humans deeply impact, and are impacted by, the state of the natural system, the social sciences can work in concert with the natural sciences to answer questions related to ways in which human and natural systems interact to influence the outcomes (and side effects) of environmental policy and natural resource management. While the 2019 Delta Science Plan included a call to establish a social science task force (Action 3.2), the 2026 iteration builds on this foundation, emphasizing the importance of social science to addressing the Delta's challenges. The 2026 Delta Science Plan includes three social science-oriented actions: Action 3.4: *Improve social science literacy*, Action 3.5: *Use social science data and disciplines to inform management decisions,* and Action 3.7*: Increase funding opportunities and capacity for social science research and collaborations.* Additionally, the new Resource B: *Making science whole: Embedding social science in natural science workflows* outlines the breadth of social sciences, dispels common myths that limit their application, and offers practical entry points for natural scientists and managers seeking to integrate the social sciences into environmental research and decision-making.

Traditional Knowledge (other ways of knowing)

Perhaps the most significant change is through the addition of grand challenge 4: *Other ways of knowing, especially Traditional Knowledge, remain siloed from decision-making*. As used in the Delta Science Plan framework, Traditional Knowledge "…is a body of observations, oral and written knowledge, innovations, practices, and beliefs that promote sustainability and the responsible stewardship of cultural and natural resources through relationships between humans and their landscapes" (Daniel et al., 2022). Traditional Knowledge offers valuable insights into the understanding of complex social-ecological systems, but many still struggle to understand how and when to meaningfully incorporate it. This under-inclusion has led to a general loss of valuable insights into biodiversity, restoration, and

sustainable futures (Simpson, 2001). Grand challenge 4 encompasses five actions that build on the adoption of the Delta Stewardship Council's Tribal and Environmental Justice Issue Paper: *Tribal and Environmental Justice in the Sacramento–San Joaquin Delta: History, Current Perspectives, and Recommendations for a Way Forward* (TEJ Issue Paper) (Delta Stewardship Council, 2025). Specifically, these actions help us address TEJ Issue Paper Strategy 3b: Embed equity and the appropriate interweaving of Traditional Knowledge – in partnership with originating tribes – in Delta science to ensure that the Delta Stewardship Council's support of science-based adaptive management and decision-making promotes equitable outcomes.

Grand challenges framework and action development

The grand challenges framework

The four grand challenges describe major impediments facing the Delta. By design, the grand challenges are rooted in multidisciplinary literature and encompass the needs of many organizations. **The resilience of the Delta's social-ecological system depends on all vested parties of the Delta working together to create strategies to address these challenges and prioritize tools that can advance progress.** The grand challenges push us to be more forward-looking and collaborative in our mission.

Criteria for grand challenges

Following the National Research Council (2001), a grand challenge must be:

i. Compelling for intellectual and practical reasons and offer the potential for major breakthroughs in science or science governance (i.e., potential for impact).
ii. Feasible to address given current capabilities and assuming a significant infusion of resources.

The four grand challenges to Delta science

- **Grand challenge #1** – Scientists and managers must anticipate a world in which environmental conditions and regulations may be fundamentally different from those faced today.
- **Grand challenge #2** – Environmental change is outpacing the traditional pace of science.
- **Grand challenge #3** – Flows of scientific information remain decentralized and poorly connected to communities and decision-makers.
- **Grand challenge #4** – Other ways of knowing, especially Traditional Knowledge, remain siloed from decision-making.

To identify and synthesize grand challenges, we reviewed visionary documents that are widely referenced by scientists and managers that are relevant to the science of the Delta, its watershed, and the broader San Francisco Estuary. A total of 32 visionary documents, published since 2007, were reviewed and 125 candidate

grand challenges were identified. These were further refined into the final four grand challenges. Please see the Grand Challenges Essay[1] for more information regarding the process to identify and synthesize the grand challenges and Appendix B*: Process to Update the Delta Science Plan* for more details about the Grand Challenges Essay public outreach process.

Action development

The 24 actions included in this 2026 Delta Science Plan to address the four grand challenges were developed through an iterative process that began with the Grand Challenges Essay and outreach efforts with the Delta ISB, public input period, 2024 State of the Estuary Conference, 2024 Bay Delta Science Conference, and February 2025 Delta Science Plan workshop. The February 2025 Workshop, which held 12 breakout groups over two days, collected feedback on strategies to address the grand challenges, resulting in a total of 533 individual comments. These comments were merged with 46 actionable items from the Grand Challenges Essay and distilled into 24 final actions, which are included in this plan based on theme, specificity, and framing. More details on this process are included in Appendix B: *Process to update the 2026 Delta Science Plan*.

The following four chapters focus on each of the grand challenges. Each chapter provides background on the grand challenge and outlines actions identified by the Delta science community to address it. To illustrate how these actions are already moving forward, each section includes a section highlighting current momentum, showcasing ongoing or planned efforts. This framework was chosen to showcase existing initiatives while encouraging new connections and inspiration for future work.

Hyperlinks

[1] https://deltascienceplan.deltacouncil.ca.gov/sites/default/files/2024-11-20-grand-challenges-in-delta-science-essay.pdf

Grand challenge 1

Grand challenge 1: Scientists and managers must anticipate a world in which environmental conditions and regulations may be fundamentally different from those faced today.

Climate change, altered hydrology, shifting species distributions, novel contaminants, and a myriad of other stressors are transforming the Delta in complex and unpredictable ways. Without a holistic management approach, we may overlook key signals of environmental tipping points, invasions, or population declines. This will require scientists and managers to work closely together to anticipate and prepare for a world in which environmental conditions and regulations may be fundamentally different from those faced today. The following chapter identifies actions to address grand challenge 1.

Monitoring

ACTION 1.1: Support the ongoing shift from single species to holistic monitoring and management of ecosystems

Current monitoring and management in the Delta are primarily driven by regulations and permits focused on individual listed species, such as Delta smelt and winter-run Chinook salmon. But there has been a recent push towards managing for ecosystem, food-web, or functional goals. A more holistic view of monitoring and management will require us to think on a larger scale to understand the drivers of change, not just their results. This paradigm shift toward managing and aiming to recover whole ecosystems will require investment, coordination, and support across local, state, and federal levels at the watershed/estuary scale to understand system-level dynamics. By supporting more multi-species monitoring efforts and ecosystem-level management initiatives, we can better anticipate and plan for the synergistic ecosystem-level changes.

Current momentum: Delta Plan Ecosystem Amendment

In 2022, the Delta Stewardship Council adopted an amendment to the Delta Plan Chapter Four[1] (*Protect, Restore, and Enhance the Delta Ecosystem*), referred to as the Ecosystem Amendment. This amendment focuses on restoring ecosystem function and implementing strategies to provide a comprehensive approach to ecosystem protection, restoration, and enhancement in the Delta.

Modeling & experimentation

ACTION 1.2: Support horizon scanning to detect and understand emerging signals

Horizon scanning is a systematic search for potential threats and opportunities to identify future challenges we haven't yet experienced. It can help identify actions needed to avoid approaching tipping points in rapidly evolving situations such as the detection of emerging contaminants and invasive species (Sutherland & Woodruff, 2009). Monitoring and modeling are necessary to foresee emerging signals and generally rely on innovative use of long-term records to explore the likelihood and magnitude of future impacts.

Current momentum: ARkStorm 2.0

ARkStorm 2.0[2] is a scenario generated from climate model projections, based on a series of intense atmospheric storms that hit the western US coastline over approximately one month. By modeling potential future storm sequences before they occur, ARkStorm 2.0 applies horizon scanning principles to anticipate flooding vulnerabilities and inform proactive resilience planning for winter storms under a changing climate.

ACTION 1.3: Strengthen links between models and data for more streamlined and informed decision-making

Strengthening the links between models and data is essential because, at present, they are often siloed, limiting their potential to inform timely and adaptive management. For example, the continuous and automated collection of water quality and remote sensing data on environmental conditions could be used to validate models that predict the likelihood of toxic and harmful algal blooms in real-time. To create better links between models and data for more streamlined and informed decision-making, we need to invest time and resources in increasing the transparency and accessibility of models across agencies. It is also imperative to identify where the most significant uncertainties lie and where models need improvement to address these uncertainties. Linking models more directly with monitoring data can further support real-time decision-making and adaptive management.

Current momentum: The Collaboratory

The term "collaboratory" is a fusion of "collaboration" and "laboratory", emphasizing the collaborative and experimental nature of scientific work facilitated by digital tools and platforms. An integrated modeling Collaboratory[3] refers to a collaborative environment or platform where researchers, scientists, and experts from diverse disciplines and communities come together to develop, integrate, and use models and data for simulating and understanding complex systems. Through its efficiencies of shared resources (data and code libraries, visualizations, etc.), a Collaboratory can accelerate discovery that serves the broad needs of the Delta science and management community (e.g., predicting harmful algal blooms) and beyond.

ACTION 1.4: Focus on regional resilience to climate change

The Delta social-ecological system is primarily influenced by actions that occur outside of the Delta, such as upstream water management practices and downstream land use and water demand. These external complexities make regional climate adaptation planning efforts more important than ever. A holistic, systemic approach to climate adaptation is essential and requires extensive collaboration and coordination across interested parties to align priorities and goals for the Delta.

Current momentum: The Delta Adapts Adaptation Plan

The Delta Adapts Adaptation Plan[4] takes a comprehensive, regional approach to climate resiliency that cuts across regional boundaries. It identifies 22 adaptation strategies (and over 100 specific actions) to address how Delta communities, infrastructure, and ecosystems can adapt to climate change. Each strategy is equipped with equity and governance considerations, proposed leads and partners, and alignment with California's Adaptation Strategy[5].

Collaboration & communication

ACTION 1.5: Improve connectivity between executive, management, and staff/scientist levels

When scientists, managers, and executives aren't well connected, their different perspectives can create blind spots. Scientists may not fully understand management's constraints and tradeoffs, while executives and managers may not

always know how science is performed, its limitations, what success looks like, or how to interpret it at a technical level. These disconnects can lead to inefficient use of resources, duplication of effort, or science that doesn't directly serve decision-making needs. Improving connectivity across these groups fosters a shared understanding of needs and priorities, strengthens trust, and enables resources to be utilized more effectively. To get there, we need repeated opportunities for interaction, training in science-to-policy communication, and inclusive forums where scientists, practitioners, and policymakers can work together to understand each other better. Removing communication barriers and creating trust-based networks helps align knowledge with power, ensuring that technical expertise and decision-making authority are more effectively integrated (Rittelmeyer et al., 2025).

Current momentum: Delta Plan Interagency Implementation Committee (DPIIC)

The DPIIC[6] strives to facilitate Delta Plan implementation through collaboration, supporting shared national, statewide, and local goals for the Delta. DPIIC established the Restoration Subcommittee in 2022, bringing together scientists and managers to identify and implement strategies that reduce barriers to landscape-scale restoration and enhance estuary-wide restoration coordination.

Synthesis & review

ACTION 1.6: Build stronger science and management goal alignment

Establishing shared goals for science and management through structured foresight and strategic planning improves the relevance and impact of research while supporting a more adaptive and responsive management framework. Co-producing goals in a collaborative process, where the needs and insights of both managers and scientists are valued, creates more substantial alignment of our efforts. This can also ensure that limited science funding is used strategically to address the most pressing challenges.

Current momentum: Science Action Agenda (SAA)

The SAA[7] is a four- to five-year focused science agenda for the Delta that prioritizes and aligns science actions to inform management decisions, identifies major knowledge gaps, and promotes collaborative science. As part of a broader Delta Science Strategy (Figure 3), the SAA establishes a foundation for funding critical

science investigations (e.g., helping guide the Delta Research Awards and Delta Science Fellowships) and tracking the impact of science activities.

Hyperlinks

[1] https://deltacouncil.ca.gov/blogs/updated-vision-and-guidance-for-restoration

[2] https://www.dri.edu/project/arkstormsierrafront-2-0/

[3] https://deltacouncil.ca.gov/delta-science-program/collaborative-modeling

[4] https://www.deltacouncil.ca.gov/delta-plan/climate-change

[5] https://climateresilience.ca.gov/

[6] https://deltacouncil.ca.gov/dpiic/

[7] https://scienceactionagenda.deltacouncil.ca.gov/

Grand challenge 2

Grand challenge 2: Environmental change is outpacing the traditional pace of science.

Environmental conditions in the Delta are rapidly changing due to climate change and human activities. Furthermore, the rates of change are becoming increasingly unpredictable, challenging our confidence in traditional scientific approaches to understanding and responding. This grand challenge reflects the need to carry out science more efficiently and nimbly to assess risks while reducing uncertainty in forecasting responses to interventions. As knowledge expands, scientific uncertainty also grows, but planning frameworks, such as decision-making under deep uncertainty and improved communication protocols between scientists and managers, can help address this uncertainty. Voluntary and collaborative groups may be well-suited to address this need by bringing together diverse interests to focus on cross-perspective information needs for water and ecosystem management. The following chapter identifies actions to address grand challenge 2.

Monitoring

ACTION 2.1: Expand adaptive monitoring and management

Adaptive management is a science-based approach for making management decisions under uncertain conditions rather than delaying action until more information is available. Fundamental to adaptive management is its cyclical nature: monitoring (i.e., measuring environmental changes) informs management decisions (e.g., changes in water operations), which in turn further refine the monitoring process. As climate change continues to reshape environmental conditions in increasingly unpredictable ways, adaptive monitoring and management will be essential to tracking and detecting changes. Linking monitoring with the design of management actions will also help to ensure that monitoring is targeted, informative, and cost-effective. Expanding adaptive monitoring and management will require dedicated, sustainable, and long-term funding; flexible regulatory frameworks to facilitate changes; improved

communication, collaboration, and data sharing across projects; and inclusive governance structures that incorporate diverse values and perspectives.

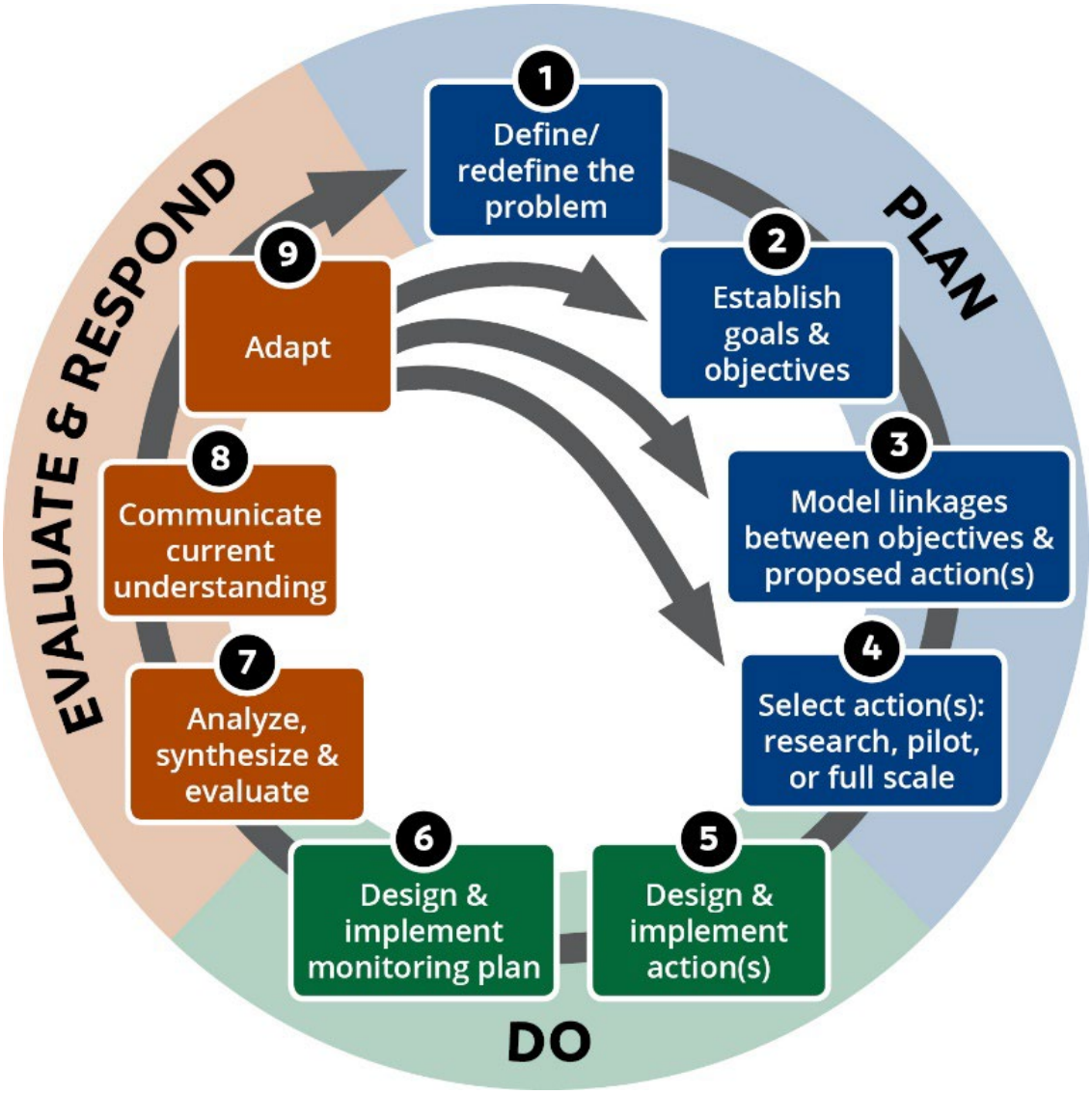


Figure 4. *The nine-step framework for adaptive management, as depicted in the Delta Plan. Boxes represent steps in the process, and the circular arrow represents the general sequence of steps. The additional arrows indicate possible next steps to address the problem or revise the selected action based on what has been learned.*

Current momentum: California State Water Resources Control Board's Bay-Delta Monitoring and Evaluation Program

This program[1] identifies biological and water quality monitoring activities needed to assess compliance with water quality objectives and inform adaptive management and potential future updates of the Bay-Delta Plan. These monitoring activities

establish baselines, identify outflow needed for ecological benefits, identify and evaluate changes in abundance and distribution of lower food web and fish populations, develop a better understanding of ecological interactions, and assess flow.

ACTION 2.2: Invest in enhanced tools and expertise in cutting-edge technology to anticipate near-future conditions

Cutting-edge tools and technologies – such as remote sensing, environmental DNA (eDNA), artificial intelligence (AI), and advanced forecasting methods – are already offering critical time and resource efficiency gains and improving our ability to predict or track water supply, water quality, salinity, and ecosystem responses – enabling more timely and informed management decisions. To effectively implement and integrate these tools, agencies must also invest in workforce development by hiring and training staff in data science and emerging techniques, as well as supporting early-career scientists in developing expertise with new technologies.

Current momentum: Forecast Informed Reservoir Operations (FIRO)

FIRO[2] is a reservoir operations strategy that provides better information for decisions on retaining or releasing water. Weather and streamflow forecasting have undergone significant improvements over the past 50 years, thanks to investments in research, modeling, monitoring, and advanced technology. As forecast skill has improved, reservoir operations have leveraged these enhanced forecasts by integrating flexibility into operational policies to maximize reservoir storage, meet flood control objectives, and mitigate flood risks as the volatility of extreme storms (e.g., atmospheric rivers) increases (Gershunov et al., 2025).

Modeling & experimentation

ACTION 2.3: Support scenario-based models that allow us to test management interventions that consider radically different future conditions

Uncertainty surrounding future environmental, social, and economic conditions has significant impacts on how decisions are made and how well those decisions hold up over time. Deep Uncertainty is defined here as unpredictable events or system variability that cannot be well-characterized using existing data, models, and understanding. Decision-Making Under Deep Uncertainty (DMDU) tools can support

better planning for the future, helping to avoid unanticipated costs associated with being underprepared for an event. A common tool of DMDU for thoroughly exploring decision outcomes under uncertainty involves using a wide range of scenarios that are developed to overcome cognitive biases (i.e., normalcy bias, optimism bias) that may not have assigned probabilities. Discussed in Action 1.2's Current Momentum, ARkStorm 2.0 is an example of scenario planning that was used to inform management changes that improve disaster preparation and response.

Current momentum: Delta ISB's review "Understanding Decision-Making Under Deep Uncertainty" (DMDU)

The Delta ISB reviewed the scientific tools and concepts that can increase the capacity to anticipate and adapt to growing uncertainty of future conditions in the Bay-Delta system. This review[3] examines the techniques and recommendations, including structured scenario development methods, that can be applied to the Delta to characterize better and prepare for uncertainty, thereby improving decision-making processes. DMDU efforts are worthwhile for decisions that are complex, difficult to reverse, and costly, so that certain management decisions don't commit us to suboptimal outcomes.

Collaboration & communication

ACTION 2.4: Support actions to cut green tape and streamline decision-making practices

Cutting the Green Tape[4] is a state-wide California initiative to accelerate the pace and scale of habitat restoration by streamlining and improving government processes. Efforts to "cut green tape" aim to improve interagency coordination, clarify permitting pathways, and simplify funding processes – while still upholding environmental protections. Supporting these actions can help deliver timely, science-based projects for restoration, stewardship, and improved resilience by reducing delays and fostering more effective collaboration among agencies and partners.

Current momentum: California Environmental Quality Act (CEQA) Statutory Exemption for Restoration Projects (SERP)

This exemption[5] provides a statutory exemption from CEQA for fish and wildlife habitat restoration projects that meet specific requirements. As of August 2025,

three projects within the Delta have utilized SERP exemptions: the Sherman Island Wetland Restoration Project, the Webb Tract Wetland Mosaic Landscape Project, and the Staten Island Wetland Restoration and Carbon Farming for Habitat, Climate, and Communities Project. On average, feedback suggests that these projects are saving approximately seven months and over $100,000 in CEQA compliance activities that would have otherwise been incurred.

Synthesis & Review

ACTION 2.5: Investigate mechanisms of sharing information more efficiently and effectively

To support timely, informed decision-making, scientific findings must be communicated efficiently, clearly, and in accessible formats. Too often, research is underutilized because results are delivered in overly technical formats or directed to narrow audiences. Additionally, the traditional pace of science – including lengthy publication timelines – can delay the integration of new information into action. Sustaining rigorous scientific peer review remains critical to maintaining the credibility of science, but mechanisms such as pre-print repositories, summary briefs, or early-release formats could accelerate the availability of key findings.

Current momentum: State of Bay-Delta Science and Delta Science Tracker

The State of Bay-Delta Science[6] is an ongoing synthesis and communication effort intended to inform science and policy audiences about the "state of the science" for topics relevant to managing the Bay-Delta system. The effort aims to distill key advances in our understanding and highlight remaining knowledge gaps for science and policy audiences through the publication of peer-reviewed articles, accessible summaries, and information sheets, as well as other avenues such as speaker series. The 2025 edition[7] features seven articles exploring extreme climate and weather events and their impacts on the Bay-Delta and its watershed.

The Delta Science Tracker[8] is a tool designed to enhance the coordination and collaboration of science activities, providing valuable insights for scientists, decision-makers, and managers in the Delta. The Delta Science Tracker allows users to explore and visualize recent research and monitoring efforts through the lenses of science activities, organizations, and people. It also enables users to access project outputs before they undergo official peer review and publication pipelines. It is intended to promote communication, create opportunities for collaboration, and enhance transparency for science funding opportunities and decisions. See

Resource C: *Science communication* for a more in-depth discussion of ongoing communication efforts in the Delta.

Funding

ACTION 2.6: Implement more responsive and targeted funding structures

To keep pace with rapid environmental change, science funding structures must become more responsive, targeted, and sustained. This action requires mechanisms such as fast-response or "surge" funding programs that enable the timely execution and reporting of research focused on emerging or urgent issues. Flexible funding structures can support targeted science when it's most needed, ensuring that findings are available to decision-makers on more actionable timelines. Without this flexible/responsive funding structure, we are likely to miss opportunities to study the effects of environmental management decisions or natural events such as the False River Emergency Drought Barrier[9] which was installed to limit salt intrusion into the Delta during drought. Responsive funding also means responsive to funding trends at a national or global scale, such as open science, which aims to make all aspects of scientific research, from data to peer review, transparent and accessible, or filling the gaps of previously federally funded science. Additionally, it will be essential to share funded research "wins" to raise the visibility of Delta science and to demonstrate the value of this investment to local communities.

Current momentum: Delta Stewardship Council's Directed Actions

Funding research is key to the Delta Science Program's mission of providing the best possible unbiased scientific information to inform water and environmental decision-making in California's Delta (*Water Code section 85280(b)(4)*). Directed Actions[10] are critical science investigations that the Delta Stewardship Council, through its Delta Science Program, awards through a non-competitive process when time is of the essence, when funds are available, and allowed by applicable law. Recent Directed Actions have advanced our understanding of sea level responses in the Delta, salinity intrusion, Early Detection and Rapid Response options, and vertical land . See Resource D: *Research funding* and Resource E: *Conflict of interest process for reviewers, advisors, and applicants* for more information on the Delta Stewardship Council's funding processes.

Hyperlinks

[1] https://www.waterboards.ca.gov/bay_delta/bay_delta_plan/docs/rev-draft-sacdelta-bdplan-updates-appendix-a.pdf

[2] https://cw3e.ucsd.edu/firo/

[3] https://www.deltacouncil.ca.gov/pdf/isb/products/2024-10-02-isb-dmdu-seminar-synthesis.pdf

[4] https://resources.ca.gov/Initiatives/Cutting-Green-Tape

[5] https://wildlife.ca.gov/Conservation/Cutting-Green-Tape/SERP

[6] https://sbds.deltacouncil.ca.gov/

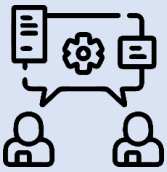
[7] https://sbds.deltacouncil.ca.gov/sites/default/files/2025-04-01-sbds-information-sheet.pdf

[8] https://sciencetracker.deltacouncil.ca.gov/

[9] https://escholarship.org/uc/item/0b3731ph

[10] https://deltacouncil.ca.gov/delta-science-program/directed-actions

Grand challenge 3



Grand challenge 3: Flows of scientific information remain decentralized and poorly connected to communities and decision-makers.

Flows of information and collaboration between "actors," such as agencies, non-governmental organizations (NGOs), tribes, academia, and collaborative groups in the Delta are highly networked, constituting a classic system of polycentric governance, whereby no one agency or decision-maker holds ultimate authority for making collective decisions (Eberhard et al., 2017). The insufficient direct and bidirectional flow of information between scientists and decision-makers has resulted in a disconnect that imposes barriers to adaptive governance (Cloern and Hanak, 2013; Norgaard, 2017; Rittelmeyer et al., 2025; Pozzi et al., 2025) and is detrimental to public trust in decision-making (Norgaard et al., 2009). Addressing this grand challenge will require investment in social science research and commitment by all information producers in the Delta to provide timely access to their information in a user-friendly way. The following chapter identifies actions to address grand challenge 3.

Data accessibility

ACTION 3.1: Support free and open data

Inconsistent data is a significant impediment to the consideration and inclusion of varied data sources in decision-making. To address this, repositories must support both data producers and users by ensuring data is Findable, Accessible, Interoperable, and Reusable (FAIR). Free and open data repositories can help build trust, foster collaboration, and support diverse uses and users. The Delta science community can support open data in many ways, including requiring data management plans and open data practices for funded research and promoting open-source platforms and decision-support tools related to water data. Refer to Resource A*: Data governance, portals, and online resources* for additional information on open data.

Current momentum: California Water Data Consortium

To achieve the vision of Assembly Bill 1755, California State agencies supported the creation of the California Water Data Consortium[1], a nonprofit organization with active state participation. The Water Data Consortium serves as a neutral space that

facilitates collaboration and sustained engagement across public, private, and nonprofit sectors to improve the data lifecycle and increase access to high-quality, comprehensive, and interoperable data to inform water decision-making.

Collaboration & communication

ACTION 3.2: Support collaborative venues for efficient flow of information

We need to enhance the flow of science information and coordination among scientists, engineers, local land managers, regulators, and the community. One way to support more inclusive governance structures for decision-making practices is by promoting cross-agency and cross-disciplinary collaborative venues for mutual learning. By supporting multi-interest venues where new findings can be discussed and information needs identified, we can increase transparency and trust. See Resource F: *Science governance and the collaborative Delta science-scape* for an updated network analysis of the leading collaborative science venues in the Delta.

Current momentum: Interagency Adaptive Management Integration Team (IAMIT)

Convened by the Delta Science Program, the IAMIT[2] is a collaborative venue that discusses and coordinates strategies for implementing adaptive management for conservation efforts in the Delta and related areas. The IAMIT serves as a technical team, comprising of scientific and technical staff from local, state, and federal agencies, as well as key interested party groups, that cross-cuts individual agency missions and provides high-level input and guidance on current and future adaptive management.

ACTION 3.3: Increase research coordination at the watershed and estuary scale through systems thinking

Increasing research coordination at the watershed and estuary scale requires a systems-thinking approach that considers the social, ecological, and economic context of complex and interconnected Delta issues. Achieving this holistic perspective is contingent upon interdisciplinary teams that intentionally link research across disciplines, geographies, and institutions. Strong communication and effective knowledge transfer facilitated through initiatives such as open data and collaborative venues will be crucial to watershed and estuary-scale projects.

Current momentum: Wetland Regional Monitoring Program (WRMP)

The WRMP[3] aims to address the challenge of differences in monitoring protocols and data management practices that limit the ability to understand restoration success and large-scale changes affecting wetlands by developing a protocol and portal to store and share comparable data. This embodies systems thinking by enabling analyses that compare the success of different restoration techniques, identify threats that inhibit success, and inform restoration design and adaptive management recommendations.

ACTION 3.4: Improve social science literacy

One of the primary impediments to the effective use of the social sciences in the Delta is a failure to fully understand and leverage the different social sciences to tackle natural resource management. A critical step is providing resources and venues to support social science and interdisciplinary research. Resource B: *Making science whole: Embedding social science in natural science workflows*, provides an in-depth discussion of the myths of social science and equips natural scientists with practical entry points for working with social scientists and social science data.

Current momentum: Bay-Delta Social Science Community of Practice

This community of practice[4] aims to facilitate collaborative social science research and interdisciplinary investigation, provide opportunities for the social sciences to inform management and policy, and advance our understanding of the estuary as a complex social-ecological system. It achieves this by bringing together social science scholars, practitioners, and interested parties who are committed to advancing research on the human dimensions of resource management in the San Francisco Bay and Delta that is both applicable and relevant.

ACTION 3.5: Use social science data and disciplines to inform management decisions

The social sciences are increasingly recognized for their role in improving the stewardship of complex and changing landscapes, such as the Delta (see Resource B: *Making science whole: Embedding social science in natural science workflows* for several case studies of impactful projects). Working in concert with the natural sciences, social science datasets and tools can help answer questions related to how human and natural systems interact to influence natural resource policy and management outcomes, and foster trust with communities. Scientists,

policymakers, and managers should leverage existing datasets with social metrics to enhance the focus and effectiveness of management decisions.

Current momentum: Delta Residents Survey (DRS)

The 2023 DRS[5] was a household survey conducted in the Delta and adjacent areas to gain a better understanding of residents' livelihoods, well-being, priorities, and concerns for the region. By capturing shared values and diverse experiences, the DRS provides insights for developing more effective and equitable resource management approaches. Understanding and tracking changes in the human dimensions of the estuary, such as residents' opinions on regional priorities and concerns, stewardship behaviors, and experiences, is crucial for effective estuary management (Rudnick et al., 2023). For more information about the DRS, see Resource B: *Making science whole: Embedding social science in natural science workflows.*

Synthesis & review

ACTION 3.6: Proactively identify opportunities to leverage independent scientific peer review processes to enhance the scientific rigor, transparency, and credibility of science underpinning management and policy decisions

Through independent scientific peer review, qualified experts are called upon to objectively evaluate processes, programs, plans, or products, which in turn help to ensure the provision of the best available science. Resource G: *Processes for independent scientific review and scientific advice* provides information about the process the Delta Science Program uses to promote high-quality independent scientific review and scientific advice. When updating regulatory documents, plans, and products, agencies can consider incorporating peer review into the process of informing decision-making at critical junctures. This can help build trust and enhance adaptive management, which is particularly useful in the face of growing disinformation and distrust in science.

Current momentum: Scientific peer review services

The Delta Science Program has been experiencing an increased demand for its independent scientific peer review[6] services. This stems from several factors, including peer reviews stipulated in State and Federal permits for operations of the State Water Project and the Central Valley Project (e.g., Incidental Take Permit and

Biological Opinion). These state and federal permit documents are critical tools in governing and mitigating the impacts of water operations on threatened and endangered species in the Bay-Delta.

Funding

ACTION 3.7: Increase funding opportunities and capacity for social science research and collaborations

Despite its importance, funding for social science has increased at a slower rate than funding for the biophysical sciences nationwide (NSF, 2018; Table 5.6). To promote relevant social science research in the Delta, funding systems should integrate social sciences into all stages of research – from early planning to communication of findings. This includes involving social scientists in the development of funding solicitations, identifying priorities, and ensuring their representation on proposal review panels. This investment also requires increasing social science capacity and expertise by creating more social scientist positions and training courses within agencies and academia.

Current momentum: Delta Research Awards

To increase funding opportunities for social science in the Delta, the Delta Science Program has included language and criteria in its Delta Research Awards[7] funding solicitations to encourage the explicit integration of social-ecological systems proposals. Delta Stewardship Council staff have been monitoring and refining these funding opportunities over time to improve both the solicitation language and the review process of social science proposals.

Hyperlinks

[1] https://cawaterdata.org/

[2] https://deltacouncil.ca.gov/delta-science-program/interagency-adaptive-management-coordination

[3] https://www.wrmp.org/

[4] https://deltacouncil.ca.gov/bay-delta-social-science-community-of-practice

[5] https://www.openicpsr.org/openicpsr/project/195447/version/V2/view;jsessionid=B4199AE8749083703A63B86AD4E0BEF6

[6] https://deltacouncil.ca.gov/delta-science-program/scientific-peer-review

[7] https://deltacouncil.ca.gov/delta-science-program/research-awards

Grand challenge 4

Grand challenge 4: Other ways of knowing, especially Traditional Knowledge, remain siloed from decision-making.

Science that includes diverse knowledge improves the effectiveness of science in the long term. For purposes of the Delta Science Plan, Traditional Knowledge "…is a body of observations, oral and written knowledge, innovations, practices, and beliefs that promote sustainability and the responsible stewardship of cultural and natural resources through relationships between humans and their landscapes. [It] cannot be separated from the people inextricably connected to that knowledge" (Daniel et al., 2022). Traditional Knowledge stemming from tribes and tribal communities, as well as other ways of knowing such as local ecological knowledge or experiential knowledge, are often siloed, despite offering important contributions to the understanding of complex social-ecological systems (Delta Stewardship Council, 2025). This lack of incorporation is partly due to the inflexibility established by years of academic training and social-political systems that limit opportunities for integrating other ways of knowing (Shinbrot et al., 2025; Huntington, 2000). This chapter following chapter identifies actions to address grand challenge 4.

Data accessibility

ACTION 4.1: Respect tribal data ownership and confidentiality

For data collected by tribes, or in collaboration with tribal partners, data management protocols that protect and respect tribal data and community ownership of that data are critical to maintaining trust (Delta Stewardship Council, 2025). Due to historical misuse and exploitation of tribal data and Traditional Knowledge, sharing sensitive tribal information is a cause for concern for tribal partners (CNRA, 2025). Sensitive data, such as the location of cultural resources, the number of cultural resources, the location of sacred sites, and the location of buried ancestors, are all types of information that may be exploited if made available to the public (CNRA, 2025). This protection can sometimes conflict with FAIR (findable, accessible, interoperable, and reusable) open data requirements (see Resource A: *Data governance, portals, and online resources* for more information on open data) and other laws applicable to transparent governance. One way to navigate these conflicts is to apply the CARE Principles for Indigenous Data Governance, which encompass **C**ollective Benefit, **A**uthority to Control,

Responsibility, and **E**thics (CARE) (Carroll et al., 2020). Tribal data management protocols should be explicitly written into agreements for projects and funding solicitations that involve Traditional Knowledge or tribal nations, to the extent that applicable law allows.

Current momentum: Tribal Grant Administration Guidance document

The California Natural Resources Agency (CNRA) has developed a Tribal Grant Administration Guidance document[1] that outlines best practices for maintaining data confidentiality and data sovereignty. One best practice recommends working closely with grantees to design reporting solutions for sensitive data. "For example, species monitoring data helps scientists understand species populations and behaviors to set protective policy and even regulatory protections, but if this is a significant, cultural species that is also vulnerable to poaching, grantees may report the approximate quantity (such as in a range) or location (such as approximate location within county) of the species but omit specifics (precise numbers, details on the observed species, exact coordinates, etc.)" (CNRA, 2025).

Collaboration & communication

ACTION 4.2: Support more co-produced and community-engaged science

Community-engaged science is a collaborative approach in which local communities actively participate in all stages of the scientific process — from identifying research priorities and co-designing studies to interpreting results and informing policy (Israel et al., 2017). When done well, this process fosters transparency and accountability, building trust between scientists and the community. Collaborating with social scientists to employ social science methods, such as participatory mapping and interviews, can help ensure that engagement is both inclusive and effective. When co-producing knowledge with community and tribal partners, creating spaces —both physical and procedural —where different ways of knowing can come together is essential for integrating Traditional Knowledge into decision-making and dismantling the structures that have historically kept it siloed. Building these relationships requires repeated, respectful interactions that demonstrate long-term commitment. As a principle of environmental justice, it is paramount that Traditional Knowledge be applied by the designated individuals of the tribe from which that knowledge originated, or with permission by and in partnership with that tribe (Delta Stewardship Council, 2025).

Current Momentum: Science for Communities (SFC)

The Delta Stewardship Council's SFC initiative[2] facilitates and fosters partnerships among Delta communities, tribes, local public agencies, and subject matter experts to explore challenges and opportunities in the Delta region. The initiative promotes the sharing of knowledge, tools, and data to support relationship building, collaboration in addressing social-environmental issues, and access to funding for further research and training. See Resource H: *Guidance for science workshops* for more information about the Delta Stewardship Council's process for hosting workshops to facilitate co-production, such as SFC.

Funding

Action 4.3: Explore ways to expand funding for research that engages community and tribal expertise

Limited resources, limited funding, and the perception of public engagement as a "box-checking" exercise rather than a process that influences decision-making all hinder community and tribal engagement in scientific decision-making processes. Additionally, traditional funding structures are often confusing and opaque, with outside parties unclear on how to engage (Delta Stewardship Council, 2025). Exploring ways to expand funding that fairly compensates community and tribal members for their expertise and aims to reduce bureaucratic burdens is important for interweaving other ways of knowing into decision-making processes. It is also important to build in flexibility that acknowledges the sometimes longer timelines, and therefore higher costs, of co-produced knowledge. This action builds on the TEJ Issue Paper[3] Goal 4: Explore ways to address funding inequities in communities that have historically received the least investment (Delta Stewardship Council, 2025).

Current momentum: Eco-Cultural Renewal of Delta Tule Landscapes

The 2025 Delta Research Awards[4] provided $5.9 million to fund eight projects. Several of the projects focused on collaborations with tribal groups, such as the Eco-Cultural Renewal of Delta Tule Landscapes[5]. This project is a partnership between the San Francisco Estuary Institute, Shingle Springs Band of Miwok Indians, and Colfax Todds Valley Consolidated Tribe. By bringing together different perspectives and knowledge to document and integrate Traditional Ecological Knowledge of tule wetlands, the project aims to integrate Traditional Knowledge into Delta management and restoration.

Governance & relationships

ACTION 4.4: Build trust through intentional and reciprocal working relationships

In the Delta's polycentric governance system, trust is essential for overcoming fragmented information flows and competing interests. By seeking local perspectives from the start, science and management can become more transparent and responsive. Early, meaningful, and frequent engagement can strengthen relationships between scientists, managers, tribes, and communities, reducing decision-making inefficiencies and fostering a sense of shared ownership of solutions. Building relationships with communities and tribes requires recognizing capacity limitations, avoiding participation fatigue, and clearly communicating the purpose of engagement. If possible, agency staff should go to tribes and communities to meet people in their spaces, on their terms, and experience their events and ways of life. Reaching people effectively requires significant effort and time (Delta Stewardship Council, 2025).

Current Momentum: Traditional Knowledge Roundtable Series

The Delta Stewardship Council's Traditional Knowledge Roundtable Series' goal is to cultivate and/or strengthen relationships between tribal and non-tribal partners in the estuary through collaboration and dialogue. By creating a space to share experiences and exchange perspectives, the series can help identify approaches for interweaving Traditional Knowledge and Western science to explore the management of the estuary. The first events are anticipated to take place in Spring 2026.

ACTION 4.5: Embrace more ways of knowing

Incorporating other ways of knowing into science-based decision-making requires a fundamental rethinking of specific academic and social-political norms. Some examples include questioning biases that commodify knowledge, shifting the values of traditional scientific culture (i.e., "publish or perish") to include community involvement, and allowing storytelling and other knowledge systems to reveal values and perspectives. Building from the TEJ Issue Paper[3] Strategy 3b (1): Embrace More Ways of Knowing, this action highlights the need for scientists to embrace new partnerships and approaches to science (Delta Stewardship Council, 2025). Eliminating systemic barriers, understanding the cultural and place-based

context, and engaging early and continuously with an open mind are essential steps in making this shift.

Current Momentum: Ecocultural Working Group for the Webb Tract restoration

The Metropolitan Water District of Southern California, owner of four islands in the Delta, including Webb Tract, reached out to Plains Miwok cultural practitioners for help in stewarding the islands from an Indigenous perspective. This connection eventually evolved into the Ecocultural Working Group[6], which includes basket weavers, healers, and other Indigenous culture bearers and practitioners. This group served as the official voice for tribal partners throughout the design process.

Hyperlinks

[1] https://resources.ca.gov/Initiatives/Tribalaffairs/TribalGrantAdminGuide

[2] https://deltacouncil.ca.gov/science-for-communities

[3] https://deltacouncil.ca.gov/pdf/2025-04-24-tribal-and-environmental-justice-in-the-sacramento-san-joaquin-delta-issue-paper.pdf

[4] https://deltacouncil.ca.gov/delta-science-program/research-awards

[5] https://caseagrant.ucsd.edu/our-work/research-projects/eco-cultural-renewal-delta-tule-landscapes

[6] https://mavensnotebook.com/2025/06/19/notebook-feature-partnering-with-tribes-to-restore-a-delta-wetland-benefits-go-both-ways/

Looking forward

The grand challenges are four major impediments facing the Delta, but they are not independent issues. Many of the actions detailed here address multiple challenges simultaneously, reflecting their interconnected nature. These actions are not a comprehensive roadmap to 'fixing' these problems, but instead represent the most fruitful opportunities for us as a Delta science community to work together on addressing shared challenges in a rapidly changing and dynamic landscape.

The Delta Stewardship Council is committed to taking a leadership role in implementing the Delta Science Plan. By proactively guiding scientific priorities developed through an open, transparent, and inclusive process with the Delta science community, we aim to catalyze collective action across the community. We encourage members of the Delta science community to use the actions and tools provided in this document to guide and strengthen efforts for a more connected, collaborative, and resilient Delta. In addition to the actions, the Resources are a tool to serve as a starting point for a variety of activities, from planning workshops or developing social science collaborations to understanding the peer review and conflict of interest processes. By implementing the 2026 Delta Science Plan and providing regular updates and opportunities for engagement, we aim to hold ourselves – and the broader Delta science community – accountable, while ensuring that our collective efforts remain coordinated and aligned in the face of rapid change**.** Addressing the grand challenges cannot be accomplished by one organization alone; success will depend on strong, sustained partnerships that bridge organizational boundaries.

Our vision for success is a Delta where management decisions are adaptive, science-based, and socially informed – anticipating and responding to environmental change at estuary, ecosystem, and regional scales. We envision a well-connected governance system in which science and management priorities are clearly communicated, effectively implemented, and supported by sustained and responsive funding. Success also means fostering an open, forward-looking science enterprise that evolves in response to environmental and community needs, ensuring a resilient, equitable, and sustainable Delta.

References

Baerwald, M. R., Davis, B. E., Lesmeister, S., Mahardja, B., Pisor, R., Rinde, J., ... & Tobias, V. (2020). An open data framework for the San Francisco Estuary. *San Francisco Estuary and Watershed Science, 18*(2).

Carroll, S., Garba, I., Figueroa-Rodríguez, O., Holbrook, J., Lovett, R., Materechera, S., ... & Hudson, M. (2020). The CARE principles for indigenous data governance. *Data science journal, 19.*

Cloern, J. E., & Hanak, E. (2013). It's time for bold new approaches to link Delta science and policymaking. *San Francisco Estuary and Watershed Science, 11*(3).

Colombano, D. D., Rudnick, J., & Rowlands, N. A. (2025). Five perspectives to advance science-informed decision-making in the era of climate. *San Francisco Estuary and Watershed Science, 23*(3).

Daniel, R. A., Wilhelm, A., Case-Scott, H., Goldman, G., & Hinzman, L. (2022). What is "Indigenous knowledge" and why does it matter? Integrating ancestral wisdom and approaches into federal decision-making. *The White House, Office of Science and Technology Policy.* https://bidenwhitehouse.archives.gov/ostp/news-updates/2022/12/02/what-is-indigenous-knowledge-and-why-does-it-matter-integrating-ancestral-wisdom-and-approaches-into-federal-decision-making/

Delta Conservancy. (2025). Why is the Delta important? https://deltaconservancy.ca.gov/why-delta-important/

Delta Stewardship Council. (2025). Tribal and environmental justice issues in the Sacramento–San Joaquin Delta: History and current perspectives. https://deltacouncil.ca.gov/pdf/2025-04-24-tribal-and-environmental-justice-in-the-sacramento-san-joaquin-delta-issue-paper.pdf

Delta Stewardship Council. (2015). Delta Plan Appendix 1A: Best available science. https://deltacouncil.ca.gov/pdf/delta-plan/2015-appendix-1a.pdf

Delta Reform Act. (2009).

Eberhard, R., Margerum, R., Vella, K., Mayere, S., & Taylor, B. (2017). The practice of water policy governance networks: An international comparative case study analysis. *Society & Natural Resources, 30*(4), 453–470.

Gershunov, A., Hatchett, B., Weyant, A., Dettinger, M., Su, L., Rhoades, A., ... & Ralph, F. M. (2025). Atmospheric rivers and floods in California's changing hydroclimate. *San Francisco Estuary and Watershed Science, 23*(3).

Hall, W. P. (2010). Decision consequence analysis: A paradigm for decision making. *Sustainable land development and restoration: Decision consequence analysis*, 75-85.

Hartman, R., Knowles, N., Fencl, A., & Ekstrom, J. (2025). Drought in the Delta: Socio-ecological impacts, responses, and tools. *San Francisco Estuary and Watershed Science, 23*(1).

Huntington, H. P. (2000). Using traditional ecological knowledge in science: Methods and applications. *Ecological Applications, 10*(5), 1270–1274.

Israel, B. A., Schulz, A. J., Parker, E. A., Becker, A. B., Allen, A. J., Guzman, J. R., & Lichtenstein, R. (2017). Critical issues in developing and following CBPR principles. In *Community-based participatory research for health: Advancing social and health equity* (3rd ed., pp. 32–35).

Lebel, L., Anderies, J. M., Campbell, B., Folke, C., Hatfield-Dodds, S., Hughes, T. P., & Wilson, J. (2005). Governance and the capacity to manage resilience in regional social–ecological systems. *Ecology and Society, 11*(1), 19.

Liew, A. (2007). Understanding data, information, knowledge and their inter-relationships. *Journal of Knowledge Management Practice, 8*(2).

Luoma, S. N., Dahm, C. N., Healey, M., & Moore, J. N. (2015). Challenges facing the Sacramento–San Joaquin Delta: Complex, chaotic, or simply cantankerous? *San Francisco Estuary and Watershed Science, 13*(3).

Norgaard, R. B., Kallis, G., & Kiparsky, M. (2009). Collectively engaging complex socioecological systems: Re-envisioning science, governance, and the California Delta. *Environmental Science & Policy, 12*(6), 644–652.

Norgaard, R. B. (2017). California's Sacramento–San Joaquin Delta: Reflections on Science, Policy, Institutions, and Management in the Anthropocene. In *Water Policy and Planning in a Variable and Changing Climate* (pp. 223-238). CRC Press.

Pozzi, T., Lubell, M., Heikkila, T., Gerlak, A. K., & Rittelmeyer, P. (2025). Learning in polycentric governance: Insights from the California Delta science enterprise. *Policy Studies Journal, 53*(1), 7–28.

Raik, D. B., & Decker, D. J. (2007). A multisector framework for assessing community-based forest management: Lessons from Madagascar. *Ecology and Society, 12*(1).

Rittelmeyer, P., Lubell, M., Hovis, M., Heikkila, T., Gerlak, A., & Pozzi, T. (2025). Knowledge is not power: Learning in polycentric governance systems. *Review of Policy Research, 42*(3), 444–465.

Rudnick, Jessica, Tomari, Kenji , Dobbin, Kristin, Lubell, Mark, and Biedenweg, Kelly. 2023 California Delta Residents Survey. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2024-07-01. https://doi.org/10.3886/E195447V2

Shinbrot, X., Harris, J., Angel, A., Lee, T., Bush, E., Chow, M., & Stern, D. (2025). Changing paradigms of knowledge production: Interweaving traditional knowledge and predominant science in the Delta. *San Francisco Estuary and Watershed Science, 23*(2).

Sutherland, W. J., & Woodroof, H. J. (2009). The need for environmental horizon scanning. *Trends in Ecology & Evolution, 24*(10), 523–527.

Wright, D. L., Nichols, C. R., Cosby, A. G., Danchuk, S., D'Elis, C. F., & Mendez, G. R. (2016). Trans-disciplinary collaboration to enhance coastal resilience: Envisioning a national community modeling initiative. *Coastal Resiliency Workshop Papers, 1.*

Glossary

The definitions in this Glossary are provided only for convenience to clarify terms as they are used in the context of the Delta Science Plan.

Adaptive management – A framework and flexible decision-making process for ongoing knowledge acquisition, monitoring, and evaluation leading to continuous improvement in management planning and implementation of a project to achieve specified objectives (Wat. Code, § 85052).

Best available science – "Best available science" refers to the use of sufficient and credible information and data, specific to the decision being made and the time frame available for making that decision, that is consistent with scientific and engineering professional standards of practice (Cal. Code Regs., Tit. 23., § 351. Definitions., (h)).

Biological Opinion – A document stating the opinion of the U.S. Fish and Wildlife Service or the National Marine Fisheries Service as to whether or not federal action is likely to jeopardize the continued existence of a threatened or endangered species or result in the destruction or adverse modification of critical habitat (The Delta Plan, 2013, page 303).

Climate change – Any significant change in measures of climate (such as temperature, precipitation, or wind) lasting for an extended period (decades or longer). Climate change may result from (1) natural factors, including changes in the sun's intensity or changes in the Earth's orbit around the sun, (2) natural processes within the climate system (such as changes in ocean circulation), or (3) human activities that change the composition of the atmosphere (for example, through burning fossil fuels) and land surfaces (for example, deforestation, reforestation, urbanization, and desertification) (The Delta Plan, 2013, page 304).

Collaboration – Sharing information and resources and modifying activities based on a common interest or objective that parties involved jointly (The Science Enterprise Workshop, 2016[1]).

Coequal goals – The two goals of providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem. The coequal goals 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 (The Delta Plan, 2013, page 297).

Cooperation – Sharing information and sometimes resources while each party pursues its own goals (The Science Enterprise Workshop, 2016[1]).

Coordination – Sharing information and resources with parties pursuing a common interest or objective. The interest or objective, however, is defined independently by each party (The Science Enterprise Workshop, 2016[1]).

Scientific credibility – the degree to which scientific claims, research, methodologies, or institutions are believable and trustworthy (The Science Enterprise Workshop, 2016[1]).

Data – Data are measurements or observations that are collected as a source of information (Australian Bureau of Statistics, 2025). Examples include measures of precipitation, water flow, and population abundance.

Data Accessibility – For the purpose of the Delta Science Plan, data accessibility refers to the ease with which individuals or systems can locate, retrieve, and utilize data. Accessibility extends beyond just physical access; it also encompasses the ability to understand the data, its format, and its relevance to a specific need or task.

Delta – "Delta" means the Sacramento-San Joaquin Delta as defined in Section 12220 and the Suisun Marsh, as defined in Section 29101 of the Public Resources Code (CA Water Code § 85058 (2024)).

Decision-maker – An individual or entity that has the authority to make decisions and allocate resources (Hall, 2010).

Delta Plan – The comprehensive, long-term management plan for the Delta to further the achievement of the coequal goals, as adopted by the Delta Stewardship Council in accordance with the Sacramento-San Joaquin Delta Reform Act of 2009 (DSC, 2025[2]).

Delta science community – For the purpose of the Delta Science Plan, the Delta science community comprises a group of scientists, including federal, state, and local agencies; academics; consultants; NGOs; Traditional Knowledge holders; and the interested public who actively participate in scientific and management activities in the Delta.

Ecosystem – A biotic community and its physical environment, considered as an integrated unit. Implied within this definition is the concept of a structural and functional whole unified through life processes. An ecosystem may be

characterized as a viable unit of community and interactive habitat. Ecosystems are hierarchical and can be viewed as nested sets of open systems in which physical, chemical, and biological processes form interactive subsystems. Some ecosystems are microscopic, and the largest comprises the biosphere. Ecosystem restoration can be directed at different-sized ecosystems within the nested set, and many encompass multiple states, more localized watersheds, or a smaller complex of aquatic habitats (The Delta Plan, 2013, page 308).

Ecosystem restoration – The application of ecological principles to restore a degraded or fragmented ecosystem and return it to a condition in which its biological and structural components achieve a close approximation of its natural potential, taking into consideration the physical changes that have occurred in the past and the future impact of climate change and sea-level rise (Water Code section 85066) (The Delta Plan, 2013, page 308).

Estuary – A place where fresh and saltwater mix, such as a bay, or where a river enters an ocean (The Delta Plan, 2013, page 309).

Forum – a place where multiple organizations and/or participants collectively develop and exchange ideas and undertake various science activities ranging from data collection, analysis, interpretation, and science communication (Rittelmeyer et al., 2024).

Framework – There is no single, universal definition for "framework," and it varies across disciplines. However, for the Delta Science Plan, a framework is a set of standards and principles from which to build a more detailed plan, program, or strategy.

Habitat restoration – The manipulation of the physical, chemical, or biological characteristics of a site to return the majority of natural functions to the lost or degraded native habitat (The Delta Plan, 2013, page 311).

Horizon scanning – A process to identify emerging trends, issues, and opportunities of importance to managers and scientists so they are better prepared to take advantage of or to react to in a well-thought-out and timely manner (Sutherland & Woodroof, 2009).

Human dimensions of natural resources – How humans value, use, and depend on the natural environment and how they affect and are affected by natural resource management decisions (University of Minnesota, 2025[3]).

Incidental Take Permit – A permit issued by federal fisheries agencies that authorizes take of listed species incidental to otherwise lawful projects (The Delta Plan, 2013, page 311).

Independent scientific review – Assessment of a scientific or management product or program by scientists with appropriate expertise and no personal or institutional stake in the outcome of the review. See Resource G: *Processes for independent scientific review and scientific advice* or the Delta Stewardship Council's web page, Delta Science Program Independent Scientific Reviews and Advice: Frequently Asked Questions[4], for more information.

Information – A product with relevant meaning used to make decisions, solve problems, or realize an opportunity. Information can come from processed data, but can also come from other forms of communication (e.g., instructions) (Liew, 2007).

Interested Party – For the Delta Science Plan, we are using the term 'interested party' to refer to any entity or individual that can influence, or will be affected by, an issue, set of findings, or action.

Invasive species – "Invasive species" means an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112[5] - Invasive Species (Section 1. Definitions)).

Local agency – Any public agency other than a State or federal agency, board, or commission. A local agency may include, but is not limited to, cities, counties, districts, public water agencies, and boards, commissions, or organizational subdivisions of a local agency (Cal. Code Regs. Tit. 14, § 15368).

Manager – For the Delta Science Plan, a manager is generally a "science manager" or "natural resource manager," who is an upper-level staff member within an agency division responsible for overseeing day-to-day functions (e.g., operations), strategic planning, and coordination and communication within the organization. Science managers may possess expertise in a technical field and participate in data analysis, monitoring design efforts, and authoring scientific publications.

Management question – For the Delta Science Plan, management questions primarily refer to high-level questions posed by natural resource managers.

Mechanism – For the Delta Science Plan, a 'mechanism' is a way of getting something done. This includes both institutional (e.g., organized entities) and procedural (e.g., bylaws and memorandum of understanding) mechanisms.

Mathematical Model (model) – A representation of a biological process, system, or relationship by means of a mathematical equation or set of equations. Models can be used to explain complex processes and predict possible future trends, such as future river temperatures or flows (Oxford Reference, 2025[6]).

Monitoring – In an environmental context, monitoring refers to ongoing sampling, analysis, measurement, and survey activities used by scientists and managers to assess the status and trends of natural resources and environmental conditions (US EPA, 2025[7]).

Open data – Data that are freely available to the public and are accompanied by sufficient documentation for their appropriate reuse (Baerwald et al., 2020).

Open science – A broader movement that aims to make all aspects of scientific research – including data, methods, software, publications, and peer review – transparent and accessible. Open science can help democratize research, leading to more inclusive, responsive, and impactful science. It relies on open data to enable collaborative knowledge-building and reproducibility (Baerwald et al., 2020).

Policymaker – Someone who is responsible for or involved in establishing policy (Merriam-Webster, 2025[8]). This can refer to individuals who develop policies for their agencies and departments, as well as those who participate at the legislative level and develop state-wide and nationwide regulations.

Public – For the Delta Science Plan, 'public' generally refers to something being open to everyone (i.e. not restricted to agency staff), such as a public comment period; or more usually referring to a group of people as the public that may not necessarily fall into the category of "scientist", "decision-maker," or "interested party".

Science – Information gathered in a rational, systematic, testable, and reproducible manner (The Science Enterprise Workshop, 2016[1]).

Science activities – For the Delta Science Plan, science activities encompass a broad range of efforts, including compliance monitoring, modeling, exercises to identify science issues that may be of management concern in the near future, research

focused on supporting decision-making, as well as more basic research that can inform future management issues.

Science co-production – Participation of managers or interested parties in the design, execution, and interpretation of scientific studies (The Science Enterprise Workshop, 2016[1]).

Science enterprise – The collection of science programs and activities that exist to serve managers and interested parties in a regional system (The Science Enterprise Workshop, 2016[1]).

Science governance – A form of collaborative governance that involves collectively prioritizing research questions, setting goals for science efforts, determining best practices for how science is conducted, and the results of these efforts (Lebel et al., 2005; Raik & Decker, 2007).

Synthesis – For the Delta Science Plan, synthesis refers to the scientific process of integrating information from multiple sources into one concept, model, finding, or report.

Tool – For the Delta Science Plan, a tool is an item used to perform a job or task (e.g., computer, guidebook, checklist, boat).

Watershed – A watershed is the land area that drains water to a particular stream, river, or lake. It is a land feature that can be identified by tracing a line along the highest elevations between two areas on a map, often a ridge (Maven's Notebook, 2025[9]).

Hyperlinks

[1] https://mavensnotebook.com/wp-content/uploads/2017/03/SEW_Complete-Proceedings-Day-1-2.pdf

[2] https://viewperformance.deltacouncil.ca.gov/the-delta-plan

[3] https://www.dnr.state.mn.us/wildlife/research/surveys/hd.html

[4] https://deltacouncil.ca.gov/delta-science-program/independent-scientific-reviews-and-advice-faq

[5] https://www.invasivespeciesinfo.gov/executive-order-13112

[6] https://www.oxfordreference.com/display/10.1093/oi/authority.20110803100139955

[7] https://www.epa.gov/measurements-modeling/monitoring-programs

[8] https://www.merriam-webster.com/dictionary/policymaker

[9] https://mavensnotebook.com/glossary/watershed/

Appendix A: Implementation successes: Status of 2019 Delta Science Plan and relevant outcomes

Background

With over a decade of progress since the initial Delta Science Plan in 2013, this appendix provides an overview of the major outcomes from the 2019 Delta Science Plan. Many 2013 Delta Science Plan actions were incorporated into the 2019 Delta Science Plan to continue ongoing work. Successes related to these action items are explored in this document. The Delta Science Program tracked progress on the 2019 Delta Science Plan throughout the interim years of 2019-2025, and examples of implementation are listed in each section below.

2019 Delta Science Plan

The 2019 Delta Science Plan actions overlapped with those of the 2013 Delta Science Plan but also included many novel initiatives. Examples of this progress are included below, and legacy actions are denoted in the title of the examples.

Many examples are crosscutting across the various actions and are not meant to be a comprehensive list of all progress. The 'Action Status' column represents the overall progress achieved for each action.

Chapter 2. Shared mechanisms to inform policy and management

This chapter aims to motivate the development and expansion of tools to support effective coordination and collaboration among Delta decision-makers, scientists, and interested parties in the Delta. While progress is ongoing for many actions, noticeable progress has been achieved through the creation of new online tracking tools (e.g., Delta Science Tracker), public workshops, and new training sessions.

Table Appx. A-1. Progress on Chapter 2 actions.

Number	Short Title	Action Status	Example related outcomes
2.1 (also Delta Science Plan 2013 Action 2.1)	Develop guidelines and best practices for policy-science forums	Ongoing	• The Collaborative Science and Adaptive Management Program (CSAMP) provided research question connections for the 2018 and 2021 Delta Science Program Research Awards and Science Action Agenda (SAA) • 2020 CAMT Salmonid Subcommittee researcher and manager discussions
2.2 (also Science Plan 2013 Action 2.2- "Develop, implement, and update SAA")	Update and continue to implement the Science Action Agenda	Ongoing	• 2022-2026 SAA was published and developed to address management needs and questions directly
2.3 (also Delta Science Plan 2013 Action 2.6)	Regularly update and publish the State of Bay-Delta Science (SBDS)	Completed and ongoing	• 2022 (primary producers) and 2025 (extreme events) SBDS published, https://sbds.deltacouncil.ca.gov/[1]
2.4	Develop, compile, and share methods for science communication to leverage existing efforts	Ongoing	• Delta Science Tracker, https://sciencetracker.deltacouncil.ca.gov/[2]

2.5	Support and enhance communication efforts and tools	Ongoing	• Convened the 2021 (virtual) and 2024 Bay Delta Science Conferences
2.6	Support opportunities for training that enhance the science communication skills of Delta scientists	Ongoing	• Early Career Leadership Workshops for Delta Science Fellows and California Sea Grant State Fellows
2.7	Ensure consistent application of scientific peer review and independent science advisors	Completed and ongoing	• Delta Science Program peer reviews, https://deltacouncil.ca.gov/delta-science-program/scientific-peer-review[3] • National Academy of Sciences review of the Long-Term Operations of the Central Valley Project and the State Water Project, https://www.nationalacademies.org/our-work/review-of-the-long-term-operations-of-the-central-valley-project[4] • Delta ISB completed reviews, https://deltacouncil.ca.gov/delta-isb/products[5]

Chapter 3. Modernize, integrate, and build the Delta science infrastructure

This chapter focuses on building the necessary science infrastructure to tackle current and expected challenges. Many actions saw progress and yielded completed products, such as for expanding social science, evaluating monitoring programs, and creating resources, processes, and tools to promote open data.

Table Appx. A-2. Progress on Chapter 3 actions.

Number	Short Title	Action Status	Example related outcomes
3.1 (also Delta Science Plan 2013 4.3.1)	Host a summit to identify useful emerging data science and technology	Ongoing	• California Water Boards Water Data Science Symposium and California Water Data Challenge, https://www.waterboards.ca.gov/resources/data_databases/wq_science_symposium.html[6]
3.2	Establish a social science task force and a strategy to engage and integrate social science research in the Delta	Complete	• Social Science Task Force Report completed (2020), Delta Social Science Task Force (ca.gov)[7]
3.3	Routinely evaluate monitoring programs in the Delta to identify gaps, redundancies, and management relevance	Complete and ongoing	• IEP Pilot Review of Long-Term Monitoring Elements 2020, https://www.usgs.gov/publications/interagency-ecological-program-long-term-monitoring-element-review-pilot-approach-and[8] • Delta ISB completed Monitoring Enterprise Review (2022), Review of the Monitoring Enterprise in the Sacramento-San Joaquin Delta (ca.gov)[9]
3.4 (also 2013 Delta	Develop a working group to facilitate monitoring	Ongoing	• CHABs Monitoring Strategy (2025), RE: Review of draft Cyanobacterial Harmful Algal Bloom Monitoring Strategy for

Science Plan 4.2.2)	program coordination and integration		the Sacramento-San Joaquin Delta (ca.gov)[10]
3.5 (also 2013 Delta Science Plan 4.1)	Establish sustainable funding for forward-looking science	Ongoing	• Release of the annual crosscut budget, FY 2020-2021 Delta Crosscut Budget Report (ca.gov)[11]
3.6 (also 2013 Delta Science Plan 4.3.2)	Develop a shared framework that broadly addresses the data lifecycle to support the goals of AB 1755 and beyond	Completed	• An Open Data Framework for the San Francisco Estuary – Baerwald et al., 2020 https://doi.org/10.15447/sfews.2020v18iss2art1[12] • State Water Board's Office of Information Management and Analysis': Strategic Data Management Action Plan[13] • IEP's Data Utilization Work Group • CA Water Data Consortium Steering Committee, https://cawaterdata.org/[14]
3.7	Promote accessibility to peer-reviewed scientific literature, data, and tools	Ongoing	• DSP established a partnership and training series with the National Center for Ecological Analysis and Synthesis (NCEAS) to build capacity for open data and open science research techniques • Delta Science Tracker • Recipients of DSP funding are strongly encouraged to use reproducible workflows, follow FAIR (findable, accessible, interoperable, reusable) data principles, publish model code, and publish journal articles using open-access services like

			the San Francisco Estuary and Watershed Science journal, https://escholarship.org/uc/jmie_sfews[15] • USGS Data portal for high frequency data in the Delta, including flow and water quality
3.8 (also Science Plan 2013 Action 4.4.1)	Develop and implement a strategy to grow the collaborative modeling community	Ongoing	• Collaboratory, Advancing an Integrated Modeling Collaboratory for the Delta (ca.gov)[16]
3.9 (also 2013 Science Plan 4.4.3)	Support high-priority model development across agencies and programs	Initiated and ongoing	• Water Temperature Modeling Platform peer review (2023), https://deltacouncil.ca.gov/delta-science-program/water-temperature-model-development-independent-advisory-panel[17] • Salinity Management Workshop Series (2022-2024) CalSim3 model development project to improve model performance for sea level rise and new restoration scenarios • 2025 DSP Collaboratory profiling initiative
3.10	Establish a shared set of best practices and protocols for focused synthesis	Ongoing	• Training materials and products from the Delta Synthesis Working Group, The Delta Science Program's Synthesis Working Group, with the National Center for Ecological Analysis[18]
3.11 (also 2013 Delta	Provide and support opportunities for	Ongoing	• Tidal Wetland Science Symposium (2023) publication,

Science Plan 4.5.1)	synthetic thinking across the Delta science and management communities		https://escholarship.org/uc/item/1pt6w706[19] • IEP Synthesis Project Work Team • Sacramento River Spring-Run Chinook Salmon Workshop (2020) https://deltacouncil.ca.gov/pdf/science-program/2020-09-08-10-sacramento-river-drainage-spring-run-chinook-workshop-summary.pdf [20] • NCEAS • DSP-CMSI symposia

Chapter 4. Support effective decision-making through science-based adaptive management and decision support tools

This chapter is dedicated to promoting actions that improve informed decision-making and adaptive management in the Delta. Actions saw significant progress, particularly for enhancing support for adaptive management and public venues for sharing adaptive management resources and lessons learned.

***Table Appx. A-3**. Progress on Chapter 4 actions.*

Number	Short Title	Action Status	Example related outcomes
4.1 (also Science Plan 2013 Action 3.2- "Develop and use adaptive management	Implement adaptive management and structured decision-making approaches more fully and consistently	Complete and ongoing	• Finalized Element and Monitoring Plans with Examples (ca.gov)[21] • CSAMP Structured Decision Making (SDM) report to discuss how and when SDM may be used as a model to support planning and adaptive management for ecosystem restoration projects

frameworks")			• Interagency Adaptive Management Integration Team (IAMIT) and Suisun Adaptive Management Advisory Team (AMAT) to promote adaptive management coordination
4.2 (also 2013 Delta Science Plan 3.1)	Provide adaptive management liaisons	Complete	• DSP staff serving as adaptive management liaisons and participating in early consultations for 31 restoration and water management projects, including the Lookout Slough Tidal Wetland Restoration Project • DSP staff participate in a variety of interagency groups to support adaptive management planning (e.g., IAMIT and AMAT)
4.3 (also Science Plan 2013 Action 3.4- "Hold an annual Adaptive Management Forum")	Convene regular adaptive management forums	Complete and ongoing	• 2021, 2023, and 2025 Adaptive Management Forums, https://deltacouncil.ca.gov/delta-science-program/adaptive-management[22]

Chapter 5. Collectively support the implementation of the Delta Science Plan

This chapter aims to further support the Delta science community in achieving the vision of One Delta, One Science: an open Delta science community that collaborates to build a shared understanding of science and has the capacity to adapt. Most progress is initiated (e.g., enhancing science funding) or ongoing (e.g.,

development of science plans), providing an opportunity to improve the coordination, tracking, and implementation of the 2026 Delta Science Plan.

Table Appx. A-4. Progress on Chapter 5 actions.

Number	Short Title	Action Status	Example related outcomes
5.1	Establish shared mechanisms and processes to enhance science funding	Initiated	• Delta Crosscut Budget • Funding partnerships for solicitations (DSP, CA Department of Fish and Wildlife Prop 1, U.S. Bureau of Reclamation, and State Water Contractors)
5.2	Develop, coordinate, and implement topic-specific Delta science implementation plans	Ongoing	• Draft Pyrethroid Research Plan, https://www.waterboards.ca.gov/rwqcb5/water_issues/tmdl/central_valley_projects/pyrethroid_control_program/pyrethroid_research_plan/[23] • Delta CHABs Monitoring Strategy (2024), https://deltacouncil.ca.gov/pdf/science-program/2024-10-21-final-delta-chabs-monitoring-strategy.pdf[24] • Healthy Rivers and Landscapes Science Plan (2024), https://resources.ca.gov/-/media/CNRA-Website/Files/Initiatives/Voluntary-Watershed-Agreements/Draft_VA_Science_Plan.pdf[25]

5.3 (also Science Plan 2013 Action 2.3- "…web-based tracking system")	Develop a web-based tracking system of science activities in the Delta	Completed and ongoing	• Delta Science Tracker (2023), Home | Science Tracker (ca.gov)[26]
5.4 (also Science Plan 2013 Action 5.4- "Implement and sustain the science infrastructure"?)	Maintain and grow the scientific expertise workforce needed to support the Delta Science Plan implementation	Ongoing	• Delta-specific Frontiers for Young Minds publication (2022), https://kids.frontiersin.org/articles/10.3389/frym.2022.615776[27] • Delta Science Fellows and State Policy Fellows • NCEAS training
5.5 (also 2013 Science Plan 2.8)	Develop and report performance measures for the Delta Science Plan	Initiated	• 2026 Delta Science Plan Appendix A

Hyperlinks

[1] https://sbds.deltacouncil.ca.gov/

[2] https://sciencetracker.deltacouncil.ca.gov/

[3] https://deltacouncil.ca.gov/delta-science-program/scientific-peer-review

[4] https://www.nationalacademies.org/our-work/review-of-the-long-term-operations-of-the-central-valley-project

[5] https://deltacouncil.ca.gov/delta-isb/products

[6] https://www.waterboards.ca.gov/resources/data_databases/wq_science_symposium.html

[7] https://deltacouncil.ca.gov/social-science-task-force

[8] https://www.usgs.gov/publications/interagency-ecological-program-long-term-monitoring-element-review-pilot-approach-and

[9] https://deltacouncil.ca.gov/pdf/isb/products/2022-03-22-isb-monitoring-enterprise-review.pdf

[10] https://deltacouncil.ca.gov/pdf/isb/products/2024-03-28-isb-comments-chab-monitoring-strategy.pdf

[11] https://www.deltacouncil.ca.gov/pdf/dpiic/meeting-materials/2022-07-14-fy-2020-21-delta-crosscut-budget-report.pdf

[12] https://escholarship.org/uc/item/02q969kt

[13] https://www.waterboards.ca.gov/resources/data_databases/strategic_data_management_action_plan.html

[14] https://cawaterdata.org/

[15] https://escholarship.org/uc/jmie_sfews

[16] https://deltacouncil.ca.gov/delta-science-program/collaborative-modeling

[17] https://deltacouncil.ca.gov/delta-science-program/water-temperature-model-development-independent-advisory-panel

[18] https://deltacouncil.ca.gov/delta-science-program/science-synthesis-working-group

[19] https://escholarship.org/uc/item/1pt6w706

[20] https://deltacouncil.ca.gov/pdf/science-program/2020-09-08-10-sacramento-river-drainage-spring-run-chinook-workshop-summary.pdf

[21] https://deltacouncil.ca.gov/pdf/science-program/2021-01-28-elements-of-amps.pdf

[22] https://deltacouncil.ca.gov/delta-science-program/adaptive-management

[23] https://www.waterboards.ca.gov/rwqcb5/water_issues/tmdl/central_valley_projects/pyrethroid_control_program/pyrethroid_research_plan/

[24] https://deltacouncil.ca.gov/pdf/science-program/2024-10-21-final-delta-chabs-monitoring-strategy.pdf

[25] https://resources.ca.gov/-/media/CNRA-Website/Files/Initiatives/Voluntary-Watershed-Agreements/Draft_VA_Science_Plan.pdf

[26] https://sciencetracker.deltacouncil.ca.gov/

[27] https://kids.frontiersin.org/articles/10.3389/frym.2022.615776

Appendix B: Process to update the Delta Science Plan

Background

The latest review and update of the Delta Science Plan was conducted to reflect the current science and management landscape in the Delta. To ensure the content is relevant to the regional needs of the Delta and to promote broad acceptance of the Delta Science Plan as a useful and valuable framework, the update process involved early and continuous engagement from the Delta science community. Although the Delta Science Program has taken the role of leading the review and update effort, improvements to the Delta Science Plan rely on the regional science community to shape the content, along with additional input and guidance from the Delta Independent Science Board and individuals with expertise in coordinating other complex systems. The approach to updating the Delta Science Plan was similar to that taken in previous iterations; however, the 2026 Delta Science Plan employs a new framework. The plan addresses the four grand challenges to effective Delta science. The grand challenges are explained in the Grand Challenges Essay[1], which provides the rationale, process, and starting ground for actionable items to address the selected grand challenges.

Grand challenges framework development and outreach

Figure Appx. B-1. *Infographic describing the process to develop the 2026 Delta Science Plan.* ****image subject to change***

The development of the 2026 Delta Science Plan began in 2022 with an effort to identify the grand challenges, envisioned and led by former Delta Lead Scientist Dr. Laurel Larsen and former Deputy Executive Officer for Science Dr. Louise Conrad.

To gather input from the greater Delta Science community, the Grand Challenges Essay was broadly shared via several avenues:

- The Delta ISB in 2023 and 2024 (14 comments)
- 45-day public comment period (43 comments)
- 2024 State of the San Francisco Estuary Conference with an interactive poster (7 comments)
- 2024 Bay-Delta Science Conference Jeopardy Town Hall and Poster

The Grand Challenges Essay was considered, finalized, and released in November 2024. This essay contains more details about the development process for the four grand challenges and is available here[1].

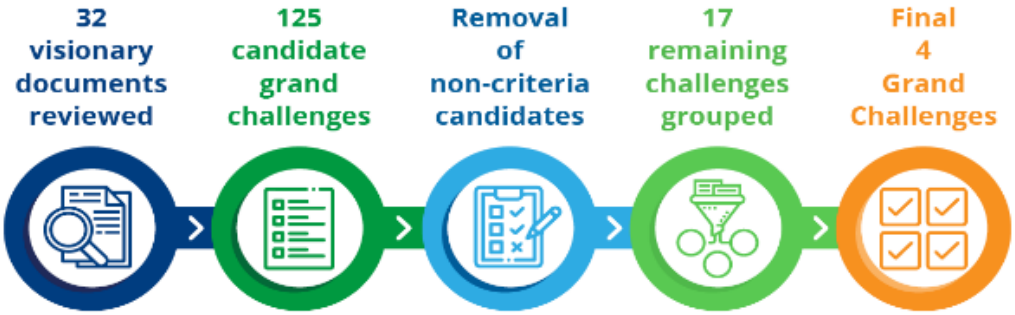


Figure Appx. B-2. *Grand challenges development process, starting with a review of 32 visionary documents on the Bay-Delta system. This resulted in 125 candidate grand challenges being pulled from a literature review, which were then reviewed against the grand challenges criteria and finally compiled into the final four grand challenges.*

February 2025 Delta Science Plan Workshop

The Delta Science Plan Workshop took place on February 20-21, 2025, with a hybrid option on Day 1 and all virtual sessions on Day 2. Presenters were selected to speak to each of the four grand challenges. Both days were recorded and are available for access here: Day 1[2], Day 2[3].

Table Appx. B-1. *Breakdown of the affiliations of the 99 total participants who attended the two-day workshop.*

Affiliation	Number of participants

Delta Stewardship Council	35 (24 were facilitators or notetakers for the event)
Other State Agencies	25
Local Agencies	8
NGOs	7
Academic	6
Federal	5
Tribal	1
Other	3

To begin the workshop, a real-time poll was used to gain a better understanding of how participants utilize the Delta Science Plan. Forty-nine attendees responded to at least one question. When asked about the new structure organized around grand challenges, 44 participants responded, and most supported the shift, ranking it highest, followed by "no preference," and with preference for the 2019 chapter and objective format ranked lowest. Participants also shared a wide range of perspectives on which 2019 actions were most frequently used and/or beneficial to their work, and which actions they would have liked to see more success from.

We also polled participants about their familiarity with the 2019 Plan's appendices. The most commonly noted were:

- *Science Governance and the Collaborative Delta Science-scape*
- *Policy and Procedures for Independent Scientific Review*
- *Policy and Procedures for Independent Science Workshops*

When asked which appendices should be prioritized for updates, *Policy and Procedures for Independent Scientific Review* and *Policy and Procedures for Research Funding* received the most support. Finally, we asked whether there were additional "informative" or "policy and procedure" documents that should be developed. Science communication and data governance were both mentioned in

the responses. See the section below, *Appendix and resource update process*, for more information on how the appendices were updated.

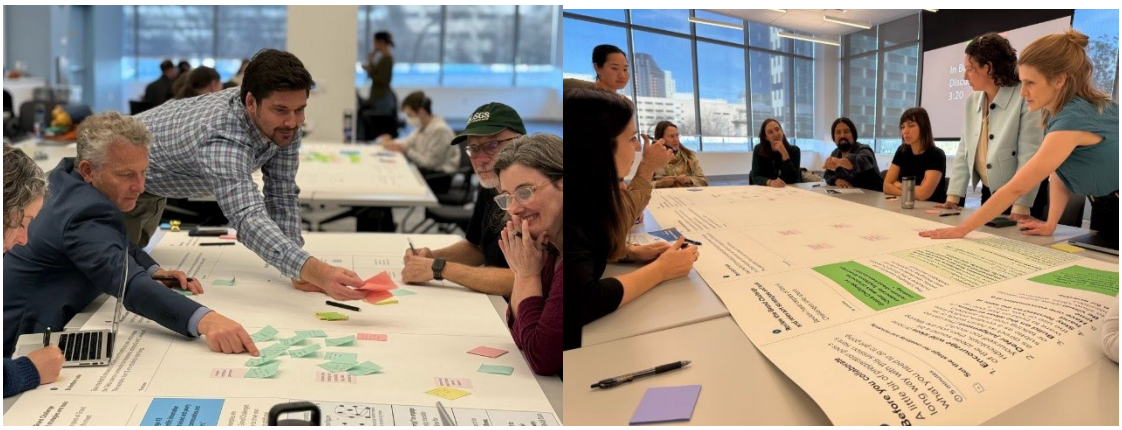


Photo caption: *Images of breakout group participants from the 2025 Delta Science Plan Workshop brainstorming tools and strategies to address the four grand challenges.*

Over the course of the two-day workshop, we also held breakout groups to collect feedback on the four grand challenges. We used the program Mural to create both online and printed interactive environments (virtual whiteboards). Each breakout group had one designated notetaker, one facilitator, and at least three additional participants. After a brief introduction, participants were asked to individually brainstorm tools and strategies that the Delta community can improve to address the grand challenge and add them to their Mural. Then, they were encouraged to discuss within the breakout group, cluster ideas based on similarity, and place them onto a priority matrix according to how much effort the tool or strategy would take and what impact it could have. Across the four grand challenges, we hosted 12 breakout groups, which resulted in a total of 533 individual comments.

Table Appx. B-2: *February 2025 Delta Science Plan Workshop breakout group details.*

	Murals	Comments
Grand challenge 1	3	158
Grand challenge 2	2	88
Grand challenge 3	5	178
Grand challenge 4	2	109

Totals	**12**	**533**

Action selection and development

The February 2025 Delta Science Plan Workshop generated 533 individual comments. These comments were condensed into 24 final actions to address the grand challenges, as detailed in the Table Appx. B-3.

Table Appx. B-3. *Distillation process for the final 24 actions to address the grand challenges.*

Idea Count	Delta Science Program Method	Outcome
533 comments	The 533 individual comments from the workshop were grouped by similarity and merged if they were determined to convey the same information to reduce redundancy	533 individual comments were merged/combined into 134 priority topics
134 priority topics	The 46 actions from the Grand Challenges Essay were added to the 134 priority topics	180 resulting priority topics
180 priority topics	The 180 initial priority topics were merged based on: 1) Theme: Individual comments that shared a common theme, goal, or concern were grouped together	90 initial draft actions
90 draft actions	The 90 draft actions were further merged based on: 2) Specificity: Comments that offered specific tools, strategies, or examples were grouped under broader outline actions that encompass a range of related ideas 3) Framing: Outline actions were crafted to be forward-looking, feasible actions.	24 final actions were organized within 7 themes that were consistent across each of the grand challenges: Monitoring, Modeling & Experimentation, Data Accessibility, Collaboration & Communication, Synthesis & Review,

		Funding, and Governance & Relationships

Draft actions were reviewed, and examples of current momentum were solicited internally.

Appendix and resource update process

Feedback from the February 2025 workshop highlighted that the appendices are a valuable resource for the community and that continuing to provide practical, informative materials through this format is important. To better reflect this usefulness, we will refer to some of the appendices as Resources, with the intention that these will become stand-alone living documents that will be more frequently updated and accessible online, outside of the Delta Science Plan.

The 2026 Science Plan now only contains two true appendices:

- Appendix A: *Implementation successes: Status of 2019 science plan and relevant outcomes*
- Appendix B: *Process to update the Delta Science Plan*

Three 2019 appendices were removed: *Process for updating the Science Action Agenda*, because this process is captured in the current SAA and on the Delta Stewardship Council's SAA web page[4]; *The State of the Bay-Delta Science (SBDS)*, because this information is captured on the Delta Stewardship Council's SBDS web page[5]; and *Delta ISB Review*, because this process is captured in all ISB reviews.

Two new Resources were added:

- Resource A: *Data governance, portals, and online resources*
- Resource B: *Making science whole: Embedding social science in natural science workflows*

These new additions reflect emerging needs identified through the workshop and broader engagement efforts, as well as recommendations from the 2019 Delta Science Plan.

The following 2019 appendices have been transitioned to be "Resources" and were updated to reflect our current practices and progress better:

- Resource C: *Science communication*
- Resource D: *Research funding*
- Resource E: *Conflict of interest process for reviewers, advisors, and applicants*
- Resource F: *Science governance and the collaborative Delta science-scape*
- The former appendices: *Policy and procedures for independent scientific review*, and *Policy and procedures for independent science advisors*, were combined into a single Resource G: *Processes for independent scientific review and scientific advice*, to reduce redundancy
- Resource H: *Guidance for science workshops*

Review

The 2026 Draft Delta Science Plan was posted for public review and comment, circulated for tribal consultation, and provided directly to the Delta ISB for review in November 2025.

Hyperlinks

[1] https://deltascienceplan.deltacouncil.ca.gov/sites/default/files/2024-11-20-grand-challenges-in-delta-science-essay.pdf

[2] https://www.youtube.com/watch?v=z8elYmMC9m4&t=11923s

[3] https://www.youtube.com/watch?v=WntiNemmWEI

[4] https://scienceactionagenda.deltacouncil.ca.gov/

[5] https://sbds.deltacouncil.ca.gov/

Resource A: Data governance, portals, and online resources

Introduction

This resource provides a basic overview of open data principles and practices that may be useful for anyone working directly or indirectly with scientific data in the Delta. The purpose of the resource is to: 1) provide one possible interpretation of open data and describe a practical approach to the data lifecycle; 2) provide background on the history and evolution of open data in the Delta; and 3) highlight key guiding documents and online resources that are relevant to the Delta science community.

Research and monitoring generate large amounts of data in the Delta, which are used to deliver management-relevant science to decision-makers (Baerwald et al., 2020). But these data are not always collected or formatted in standardized ways that allow them to be combined with other similar data, or they may be difficult to access or understand (Hale et al., 2015). To increase the efficiency of data use and re-use, the Delta science and management community has moved toward an "open data" framework to facilitate collaboration, ensure transparency, and increase the capacity for data synthesis, all of which can help generate new insights on the system and its management (Baerwald et al., 2020).

What is open data?

The California Open Data Portal[1] is a statewide open data portal operated by the Government Operations Agency. According to the California Open Data Portal, open data refers to information that can be freely used, shared, and built upon by anyone, anywhere, for any purpose (California Open Data Portal, 2025). Open data must be publicly available in a discoverable data portal without cost or restrictions, stored in a machine-readable and open format such as CSV or JSON, and accompanied by sufficient metadata. Open datasets must also be published and updated promptly to ensure they are usable and relevant. Open data practices align closely with the FAIR principles of data management, which state that data should be Findable, Accessible, Interoperable, and Reusable (Wilkinson et al., 2016).

Ensuring that data is easily discoverable, stored in standard formats, and adequately documented makes it easier for different institutions to collaborate and helps to ensure that research is reproducible and verifiable. It also enables the

integration and synthesis of data from multiple sources and across various disciplines to generate new knowledge. Making data accessible to and usable by the public also increases transparency and can help promote innovation and scientific advances. Overall, increased access to more comprehensive, interoperable datasets promotes better and more efficient science-informed decision-making.

Open data is closely related to open science, a broader movement that aims to make all aspects of scientific research – including data, methods, software, publications, and peer review – transparent and accessible. Open science can help make research more accessible and lead to more inclusive, responsive, trusted, and impactful science. It relies on open data to enable collaborative knowledge-building and reproducibility.

The data lifecycle

The data lifecycle is a framework for understanding and describing the various stages through which data passes during its journey from collection to application, encompassing storage, analysis, and other related processes (Delta Stewardship Council, 2019). There are many ways to represent the data lifecycle, but it is important to examine the data lifecycle through the lens of open data. The 2019 Delta Science Plan included a diagram of a data lifecycle (Figure A-1) that is driven by a management need or scientific hypothesis, which helps characterize how the required data can adhere to the principles of open data and open science throughout its journey. The Delta Stewardship Council and numerous other institutions working within the Delta contribute to various stages of this lifecycle.

As described in the 2019 Delta Science Plan (page 35), the eight stages in the data lifecycle naturally follow one another, but the process is not always linear. The eight stages are:

1. **Plan**: identify the type of data needed and how it will be collected, managed, and made accessible

2. **Collect**: gather observations and apply checks and inspections to ensure the quality of the data

3. **Store**: submit data and sufficient metadata to an appropriate long-term archive

4. **Provide access**: make data accessible to external users for informative purposes, including decision-making and learning

5. **Analyze**: combine data from disparate sources to form one homogeneous data set and analyze together
6. **Transfer knowledge**: communicate results using interactive maps, graphs, dashboards, and so on
7. **Make decisions**: base management decisions on knowledge gained through data
8. **Assess data**: ensure that data collection continues to provide relevant information

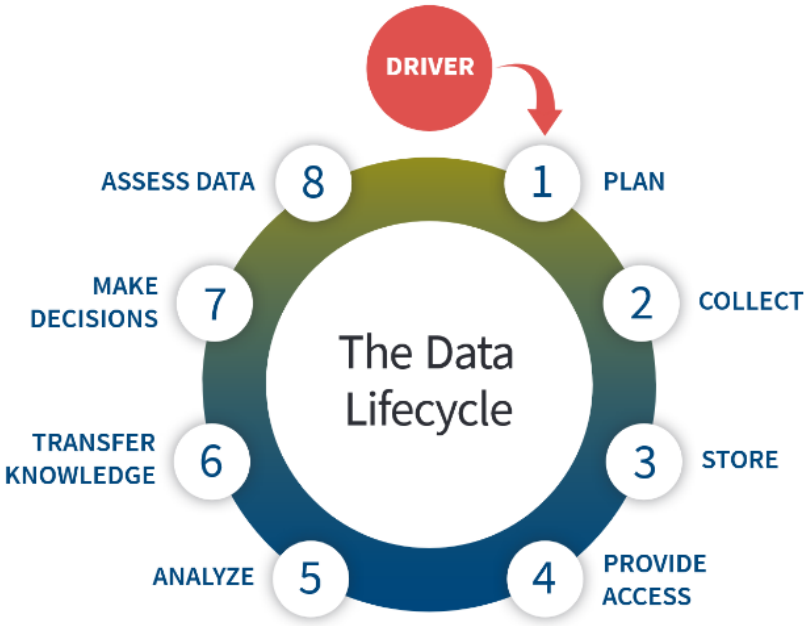


Figure A-1. Major steps involved the data lifecycle. *A management action or a hypothesis drives the data lifecycle. While the eight steps present a natural progression, the process is not always linear, and feedback loops can be important. The eight steps consist of (1) Plan: identify the type of data needed, how it will be collected, managed, and made accessible; (2) Collect: gather observations and apply checks and inspections to ensure the quality of the data. Collection methods may change over time to address the same driver; (3) Store: submit data (and metadata that include a description of data quality) to an appropriate long-term archive; (4) Provide access: make data accessible to external users to inform various purposes including decision-making and learning; (5) Analyze: combine data from disparate sources to form one homogeneous data set and analyze together; (6) Knowledge transfer: communicate results using interactive maps, graphs, dashboards, etc.; (7) Make decisions: base management decision on knowledge gained*

through the data cycle; and (8) Assess data: ensure that data collection continues to provide relevant information.

Open data and the Delta Stewardship Council: A brief history

In 2014, the Delta Science Program helped to coordinate the Environmental Data Summit, a seminal summit on data sharing and management in the Delta, which was driven by priorities identified in the 2013 Delta Science Plan. This summit led to the publication of the white paper, "Enhancing the Vision for Managing California's Environmental Information" (Hale et al., 2015). Following this effort and others, the California Legislature passed the Open and Transparent Water Data Act (Assembly Bill 1755, Dodd) in 2016. The bill requires the Department of Water Resources, in consultation with the California Water Quality Monitoring Council, the State Water Resources Control Board, and the California Department of Fish and Wildlife, to "create, operate, and maintain a statewide integrated water data platform; and to develop protocols for data sharing, documentation, quality control, public access, and promotion of open source platforms and decision-support tools related to water data" (Cantor et al., 2018).

The following table highlights key guiding documents and online resources that provide information on open data best practices, protocols, and other relevant resources for the Delta science community.

Table A-1. *Key guiding documents or online resources with information on open data best practices, protocols, or other resources.*

Type	Description	Reference
Article	Open data framework for the Delta	Baerwald et al. (2020)
Report	California's open and transparent water data act	Cantor et al. (2018)
Report	Environmental Data Summit 2014	Hale et al. (2015)

Article	Findable, accessible, interoperable, reusable (FAIR)	Wilkinson et al. (2016)
Article	Collective benefit, authority to control, responsibility, ethics (CARE)	Carroll et al. (2021)
Article	Tribal data sovereignty in the Delta	Shinbrot et al. (2025)
Website	Interagency Ecological Program (IEP) Data Utilization Working Group	https://iep.ca.gov/Data/Data-Utilization-Working-Group
Website	Delta Science Program and National Center for Ecological Analysis and Synthesis (DSP-NCEAS) Synthesis Working Group	https://deltacouncil.ca.gov/delta-science-program/science-synthesis-working-group
Website	Delta Science Tracker	https://sciencetracker.deltacouncil.ca.gov/
Repository	California Open Data Portal	https://data.ca.gov/
Repository	Environmental Data Initiative (EDI)	https://portal.edirepository.org/nis/home.jsp
Repository	ScienceBase Catalog	https://www.sciencebase.gov/catalog/
Website	National Science Foundation (NSF) - Preparing Your Data Management and Sharing Plan	https://www.nsf.gov/funding/data-management-plan

Website	AB 1755: Open and Transparent Water Data Platform for California	https://water.ca.gov/ab1755

References

Baerwald MR, Davis BE, Lesmeister S, Mahardja B, Pisor R, Rinde J, Schreier B, Tobias V. 2020. An open data framework for the San Francisco Estuary. San Franc Estuar and Watershed Sci. 18(2). *https://escholarship.org/uc/item/02q969kt*

Cantor A, Kiparsky M, Kennedy R, Hubbard S, Bales R, Pecharroman LC, Guivetchi K, McCready C, Darling G. 2018. Data for water decision making: Informing the implementation of California's open and transparent water data act through research and engagement. Available from: *https://escholarship.org/uc/item/9x62x0g2*

Delta Stewardship Council, Delta Science Program. 2019. Delta Science Plan: Vision, principles, and approaches for integrating and coordinating science in the Delta.

Hale T, Azimi–Gaylon S, Fong S, Goodwin P, Isaac G, Osti A, Shilling F, Slawecki T, Steinberg S, Tompkins M. 2015. Enhancing the vision for managing California's environmental information. Sacramento (CA): Produced by the Environmental Data Summit Organizing Committee under the leadership of the Delta Stewardship Council's Delta Science Program. Available from: https://www.sfei.org/sites/default/files/biblio_files/2015-9-25-White-Paper-approved-designR9-FINAL-v6.pdf

Carroll SR, Garba I, Figueroa–Rodriguez OL, Holbrook J, Lovett R, Materechera S, Parsons M, Raseroka K, Rodriguez–Lonebear D, Rowe R, et al. 2020. The CARE principles for Indigenous data governance. Data Sci J. 19(1):43. https://doi.org/10.5334/dsj-2020-043

Wilkinson, M., Dumontier, M., Aalbersberg, I. *et al.* The FAIR Guiding Principles for scientific data management and stewardship. *Sci Data* 3, 160018 (2016). https://doi.org/10.1038/sdata.2016.18

Shinbrot X, Harris J, Angel A, Lee T, Bush E, Chow M, Stern D. 2025. Changing Paradigms of knowledge production: Interweaving Traditional Knowledge and predominant science in the Delta. San Franc Estuary Watershed Sci. 23(2). https://doi.org/10.15447/sfews.2025v23iss2art1

Hyperlinks

[1] https://data.ca.gov/

Resource B: Making science whole: Embedding social science in natural science workflows

Changes in the Sacramento–San Joaquin Delta (Delta) and many other complex social-ecological systems are outpacing traditional approaches to science and management, underlining the need for researchers and natural resource managers to prioritize and respond with limited resources (Lee et al., 2024). The social sciences provide tools to help navigate these management challenges by focusing on understanding community values, institutional structures, and behavioral change needs – all of which are critical to setting priorities, evaluating trade-offs, and designing adaptive responses (Biedenweg et al., 2020) (Box B-1). For example, the Delta Stewardship Council's 2023 Delta Residents Survey (DRS) revealed key concerns among Delta residents regarding where they obtain information, whom they trust, and their top priorities (Rudnick et al., 2023, Case Study 1). Insights like these can inform which projects should be funded to maximize impact, and how communities engage in conservation, restoration, and research – ultimately making science and science investments more comprehensive, relevant, actionable, and successful.

Box B-1. What are the social sciences?

The social sciences are the systematic study of classic disciplines (e.g., anthropology, sociology, economics, political science, psychology) and applied disciplines (e.g., education, communications) (Niemiec et al., 2021). Together they work to "understand, describe, theorize, deconstruct, imagine, or plan" social phenomena (Bennett et al., 2017). These fields range from environmental economics – asking questions like: How much are people willing to pay for clean water? What incentives are needed to improve conservation behaviors? – to environmental governance – asking questions like: What formal and informal rules affect conservation outcomes? The social sciences can be used to understand how to communicate climate change in a way that resonates, how community values influence restoration priorities, or how institutions collaborate (or not) for co-management.

Despite this demonstrated value, social science remains underutilized in conservation, restoration, and water management (Bennett et al., 2017; Fox et al., 2006) – an issue that persists in the Delta (Biedenweg et al., 2020). The purpose of

this resource is to demystify common myths about social science and provide natural scientists with practical entry points for collaborating with social scientists and utilizing social science data. Examples in this document highlight success stories in the social sciences, as well as possible ways for academic researchers, agency scientists, and managers to directly engage in or support social science integration efforts in the Delta.

Myth 1: Social science is a soft science

Social science is often dismissed as "soft," implying it is less objective, less empirical, or less scientific than fields like biology, chemistry, or physics. This myth persists in part because social science deals with human behavior, values, and institutions – domains that are dynamic, variable, and hard to control. However, this complexity is countered by rigorous methods. Social scientists require many of the same elements as researchers in the natural sciences: they develop hypotheses, conduct experiments, construct and operate theoretical frameworks, collect empirical data, and use systematic methods or modeling to test and refine the hypotheses. For example, a conservation social scientist might hypothesize that decentralized water governance leads to more adaptive policy outcomes. A null hypothesis would posit that there is no relationship. They could test this using comparative case studies, regression models, or even experimental designs. Interested yet? Such studies have already been conducted by Andersson and Ostrom (2008). Similarly, a sociologist studying public trust in science might design a randomized survey experiment to test whether different message framings influence attitudes toward environmental policy (Ophir & Jamieson, 2021) or marine conservation behaviors (Kolandai-Matchett & Armoudian, 2020) – a method directly analogous to experiments in the natural sciences. For more background and examples, see the Delta Social Science Task Force report (Biedenweg et al., 2020).

Where social science differs from natural sciences is not in rigor, but in its approach to complexity. Social systems are shaped by meaning, power, and culture – and to understand them, social scientists draw from a broader range of ontological (what counts as real), epistemological (how we know it), and methodological (how we study it) traditions. Rather than seeing the researcher as a detached observer, these traditions often emphasize reflexivity and positionality – acknowledging that researchers are not neutral observers; instead, their values shape how they interpret information and experiences (Haraway, 1988; England, 1994). Far from undermining objectivity, this makes the work more transparent and accountable.

Myth 2: Social science is just public participation

Social science is often misunderstood as merely facilitating public engagement or communication. In environmental management and policy, this leads to the misconception that social scientists are only valid after technical work is complete, to "translate" science for the public, or to help check an engagement box. While participatory methods, such as interviews, focus groups, or co-design, are valuable components of some social science approaches, they represent only a fraction of the field's full scope. For example, political science and institutional analysis help illuminate why specific governance arrangements succeed or fail in managing shared resources (Ostrom, 1990). Behavioral economics identifies how cognitive biases and heuristics influence decision-making under uncertainty (Independent Science Board, 2024; Tversky & Kahneman, 1974; Shogren et al., 2010). Sociology and human geography provide critical insights into how power, culture, and identity shape environmental conflict, collaboration, and knowledge production (Forsyth, 2003; Escobar, 2008). These contributions go well beyond outreach – they are foundational to designing workable, equitable, and effective research. Ignoring social science until the natural science research is ready to be implemented often results in solutions that are sound in theory but socially unviable.

Easy entry points to social science

What are the easy entry points for natural scientists and managers interested in the social sciences?

1. Collaborate with social scientists early on

If you are planning on conducting surveys, interviews, workshops, or other work involving research on and with people, the best way to make sure you are ethically collecting that data is to work with a social scientist. Social scientists can help determine whether Institutional Review Board (IRB) requirements for human subjects research are necessary, design ethically sound studies, including identifying the most relevant questions to ask and determining the optimal order, and enhance data quality. The consequence of conducting research without IRB approval can be severe: suspension of research, loss of funding, publication retraction, legal liability if participants are harmed, and damage to your credibility and professional reputation. See Box B-2 on where to find social scientists.

Box B-2. Where do I find a social scientist?

Social scientists are housed at most academic institutions – start by asking around! You may also begin by reading papers in your field to see what kinds of social sciences are most applicable and who conducted the research. Alternatively, you can obtain customized research through consultants like Gallup, which designs surveys and conducts focus groups. In the Delta, you can explore the Delta Stewardship Council's Social Science Integration Web page[1] and the list of Bay-Delta Social Science Community of Practice members[2] interested in Delta human dimensions topics (https://deltacouncil.ca.gov/bay-delta-social-science-community-of-practice). If you're still searching for more information, reach out to the Delta Stewardship Council's Social Science Integration Team at socialscience@deltacouncil.ca.gov.

2. Integrate social data into models and analyses

Social-ecological systems (SES) models encompass social, ecological, and spatial scales, serving as an appropriate framework for natural and social scientists to bring together diverse interests and actors (Steger et al., 2020). Natural scientists are often already familiar with the range of data they can engage with to understand landscape or population change; however, they usually lack an understanding of the social drivers (Zimmerer and Bassett, 2003). For example, models that forecast regional climate change may not incorporate local-level human drivers, such as land use change, even though these may present the highest vulnerability to the system (Altaweel et al., 2009). Box B-3 illustrates a few examples of social science data sets that natural science researchers can start to explore. Case Studies 2 and 3 include a discussion of integrating social and biophysical data.

Box B-3. Social science datasets

There are several open-access datasets with social metrics that serve as useful starting points for natural scientists. National and global resources include NASA's Socioeconomic Data and Applications Center, which offers gridded data on population, poverty, and urbanization; the U.S. Census Bureau and American Communities Survey provide decadal demographic assessments; the World Values Survey captures global public attitudes toward science, governance, and the environment; the Zillow Home Value Index provides information on markets and home values since 2023; and InVEST is a suite of software models for mapping and economic valuing of ecosystem services created by the Natural Capital Project.

3. Start learning social science methodologies

Familiarity with interviews, surveys, case studies, or discourse analysis enhances interdisciplinary collaboration and reduces the risk of misinterpretation. Even a basic understanding improves the framing of joint research. Researchers, both from academia and agencies, can start by signing up for and reading applied interdisciplinary journals (e.g., *Global Environmental Change*, *Ecology & Society, Environmental Science & Policy*) to see how social science complements ecological questions. Other resources include Rebecca Lave's and Stuart Lane's (2025) "The Field Guide to Mixing Social and Biophysical Methods in Environmental Research[3]," an open-access book with interdisciplinary chapters, such as "Engaging remote sensing and ethnography to seed alternative landscape stories and scripts." There are also several social science training options, including self-paced behavior-centered design courses through Rare's Center for Behavior and the Environment, community-based social marketing courses led by Douglas McKenzie-Mohr, and evidence-based conservation training sessions with Brooke Tully[4].

4. Co-design research with non-scientists

Co-design – i.e., collaboratively developing questions, methods, and goals with those affected by environmental decisions – can improve the relevance and impact of scientific work. Social scientists bring expertise in participatory methods that help navigate power dynamics, ensure inclusive representation, and build trust with communities. This is especially important in regions like the Delta, where diverse groups hold competing values and histories with land and water management (Delta Stewardship Council, 2025). Research co-designed with local actors is more likely to reflect real-world needs, avoid blind spots, and generate actionable findings (Beier et al., 2017; Norström et al., 2020) (See Case Study 3). For natural scientists, partnering with social scientists in this way not only enhances the use of findings but can also more directly benefit Tribes and communities while helping to meet agency mandates for equity, transparency, and collaboration.

5. Address funding and capacity concerns

Two of the most fundamental barriers to incorporating social science on a large scale are a lack of funding and a lack of capacity. Designing research solicitations that incorporate social sciences and participatory approaches is one effective way to integrate social sciences. For example, in 2021, the Delta Stewardship Council began accepting proposals for Integrated Social-Ecological Systems research and funded two proposals in this category (Delta Stewardship Council, n.d.; see Case

Study 2). By 2025, the Delta Research Awards required interested researchers to describe whether and how they were engaging with Tribes or local communities – using the Delta Stewardship Council's social vulnerability index (SoVi) (https://deltascience.shinyapps.io/Delta_vulnerability_map/[5]) – and whether and how they were employing participatory research methods. Applications with a substantial social science component earned up to 7% more points during the scoring process. The Delta Stewardship Council also assisted in identifying tribal or community partners and facilitated partnerships through a survey sent to researchers, community-based organizations (CBOs), Tribes, and tribal-serving organizations to gauge research interests and needs.

To further catalyze social science integration and research, in 2020, the Delta Stewardship Council started funding a Social Science Extension Specialist (SSES) through California Sea Grant. The first SSES, Dr. Jessica Rudnick, was instrumental in launching and implementing the Delta Residents Survey (DRS) (Case Study 1), the Bay-Delta Social Science Community of Practice, and setting the groundwork for the Tribal and Environmental Justice Issue Paper (Delta Stewardship Council, 2025).

Case studies

Case Study 1: Delta Residents Survey

The 2023 California Delta Residents Survey (DRS)[6] was an effort to gain a deeper understanding of the people who live in the Delta. Historically, most Delta research and monitoring have focused on ecological and hydrological conditions, with less attention paid to how residents experience, influence, and are affected by environmental changes and policy decisions. The DRS sought to address that imbalance by reaching over 2,300 residents across rural and urban communities in the Delta and Delta-adjacent areas. Surveys were sent to 82,000 households and received a response rate of 2.9%, roughly double the typical rate for similar large-scale community surveys, indicating strong community engagement. The survey had four core goals: 1. Characterize residents' sense of place; 2. Assess the well-being of a diverse and evolving population residing in the region; 3. Understand residents' experiences and perceptions of environmental and climate change across the estuary; 4. Evaluate residents' civic engagement and perceptions of governance in the region.

Survey results highlighted that the Delta is not a homogeneous community – residents differ in what they value, what concerns them, and how they relate to the region. For example, rural residents emphasized quietness and scenic beauty, while

urban residents valued recreation. Concerns about climate change were widespread but took different forms across communities. Notably, the survey also revealed disparities in well-being and access to resources, pointing to environmental justice challenges that require targeted policy responses. By capturing shared values and diverse experiences, the DRS provides insights for more effective and equitable communication, outreach, and planning. Agencies working on climate adaptation, for instance, can use these insights to tailor messages that resonate with specific communities. Furthermore, survey results showed that a majority of Delta residents trust scientific experts, local residents, and community advisory groups more than policy makers at local, state, or federal levels to make decisions in the best interest of the Delta. This underscores the importance of government agencies collaborating with local community groups, community leaders, and scientists when engaging with residents. This effort marks a significant advancement in understanding the social landscape of the Delta and is intended to be a recurring survey that can track the well-being of an evolving population.

Case study 2: Collective action for Phragmites control

Invasive species management in the Delta presents both ecological and social challenges, particularly in mixed-ownership landscapes like Suisun Marsh. An interdisciplinary team led by John Takekawa from Suisun Resource Conservation District (SRCD) and researchers from six academic institutions sought to integrate social science into efforts to manage the rapid spread of *Phragmites australis* (Phragmites)[7]. This nonnative invasive plant has increased in cover by over 230% between 2003 and 2018. Its spread across Suisun Marsh threatens the function of wetlands by impeding navigation, increasing fire risk, and reducing critical habitats for wildlife. It requires coordinated efforts across property boundaries (i.e., collective action) to achieve shared goals.

To address this issue, the research team conducted remote sensing to map the plant's spread, field and greenhouse experiments to study the revegetation response following Phragmites removal, and a retrospective analysis of herbicide treatments. Importantly, they also recognized that the success of invasive species management in Suisun Marsh hinges on landowner participation in invasive species removal together. To better understand these social dynamics, the team employed a combination of social science methods, including semi-structured interviews, a landowner survey, and a spatial prioritization model that identified high-value zones for Phragmites control. These approaches helped identify key factors that

facilitate or hinder collective action for managing invasive plants, providing a comprehensive understanding of the extent of the Phragmites invasion.

Interviews with interested parties, including duck club members, NGOs, and government representatives, revealed widespread distrust of state and federal agencies and frustration with perceived inaction on public lands. In contrast, SRCD was consistently viewed as trustworthy due to its local presence, shared values, and strong relationships with landowners. Their spatial prioritization model for Phragmites control balanced ecological urgency with the likelihood of landowner engagement, yielding useful insights on how to build trust and improve communication. A key takeaway from this case study is that invasive species control in Suisun Marsh is more effective when it addresses the social dimensions of land management. The mixed-ownership mosaic, common in the Delta, necessitates collective action, which is facilitated when conservation efforts are grounded in trust, shared values, and meaningful collaboration.

Case Study 3: Participatory mapping for Frank's Tract Futures

Frank's Tract is a nearly 3,000-acre flooded island in the central Delta, situated at the intersection of significant ecological, social, and economic challenges. The tract is well-used for recreational activities such as boating, hunting, and fishing; however, it is also a significant contributor to salinity intrusion into the central Delta, which, during drought years, threatens the reliability of the water supply. In 2017–2018, the California Department of Fish and Wildlife completed an initial feasibility study proposing restoration to manage salinity intrusion and support Delta smelt habitat. However, the plan met significant resistance from the local community due to concerns about reduced navigability and recreation opportunities. Researchers launched Frank's Tract Futures project to co-design a suite of multi-benefit futures that ensured the local community's needs were represented (CDFW, 2020).

A key part of the project was a participatory mapping exercise – one of many social science tools – that allowed participants to map out common boating routes, pinpoint culturally important resources, and identify areas of the design that they liked or disliked. These results directly informed the design process and were made publicly accessible through an interactive map. Despite these efforts to involve the community in the planning process, Frank's Tract Futures highlights major and continuing challenges to the planning process in the Delta – a lack of trust in government-led processes, limited funding, and frustration/participation fatigue

from repeated engagements that fail to deliver tangible results (Maven's Notebook, 2024)

Conclusions

This resource outlines the breadth of social sciences, dispels common myths that limit their application, and demonstrates how social science methods – from surveys and interviews to institutional analysis and participatory mapping – enhance both the rigor and relevance of conservation and water management efforts. By connecting natural and social sciences, building partnerships early, and addressing barriers like funding and capacity, researchers and agencies can better navigate complex social-ecological challenges, foster trust with communities, and ultimately produce more equitable, actionable, and durable outcomes for the Delta.

References

Andersson, K. P., & Ostrom, E. (2008). Analyzing decentralized resource regimes from a polycentric perspective. Policy sciences, 41(1), 71-93.

Beier, P., Hansen, L. J., Helbrecht, L., & Behar, D. (2017). A how-to guide for coproduction of actionable science. Conservation Letters, 10(3), 288–296.

Bennett, N. J., Roth, R., Klain, S. C., Chan, K. M., Clark, D. A., Cullman, G., ... & Veríssimo, D. (2017). Mainstreaming the social sciences in conservation. Conservation Biology, 31(1), 56-66.

Biedenweg, K., J. Sanchirico, H. Doremus, R. Johnston, J. Medellín-Azuara, & C.M. Weible. 2020. A Social Science Strategy for the Sacramento-San Joaquin Delta. Report delivered to the Delta Stewardship Council.

California Department of Fish and Wildlife (CDFW). Franks Tract Futures 2020 Reimagined: Options for enhancing navigation, recreation, ecology, and water quality in the central Delta. Sept 30, 2020. https://app.box.com/s/zf17sqqd8lse6osgruorfnkm1wxkpv57

Delta Stewardship Council. (2025). Tribal and Environmental Justice in the Sacramento-San Joaquin Delta: History, Current Perspectives, and Recommendations for a Way Forward.

Delta Stewardship Council. (2021). Delta Adapts Vulnerability Assessment.

England, K. (1994). Getting Personal: Reflexivity, Positionality, and Feminist Research. The Professional Geographer, 46(1), 80–89.

Escobar, A. (2008). Territories of Difference: Place, Movements, Life, Redes. Duke University Press.

Forsyth, T. (2003). Critical Political Ecology: The Politics of Environmental Science. Routledge.

Fox, H. E., Christian, C., Nordby, J. C., Pergams, O. R., Peterson, G. D., & Pyke, C. R. (2006). Perceived barriers to integrating social science and conservation. Conservation Biology, 1817-1820.

Haraway, D. (1988). Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective. Feminist Studies, 14(3), 575–599.

Independent Science Board. (2024). Understanding decision-making under deep uncertainty: A summary and synthesis of information learned from a seminar series. The first product from the Delta Independent Science Board's review.

Kolandai-Matchett, K., & Armoudian, M. (2020). Message framing strategies for effective marine conservation communication. Aquatic Conservation: Marine and Freshwater Ecosystems, 30(12), 2441-2463.

Lave, R., and Lane, S. (2025). The Field Guide to Mixing Social and Biophysical Methods in Environmental Research."

Lee, T., Larsen, L., Klopfenstein, R., DeBey, H., Windham-Myers, L., & Bush, E. 2024. Grand Challenges to Delta Science: Planning for Science in a Dynamic System. Delta Stewardship Council.

Maven's Notebook. SCIENCE FEATURE: Testing and making futures: Participatory scenario planning in California's Delta. May 2024. https://mavensnotebook.com/2024/05/07/science-feature-testing-and-making-futures-participatory-scenario-planning-in-californias-delta/

Mount, J., Hanak, E., & Gartrell, G. (2022). The Sacramento-San Joaquin Delta. Public Policy Institute of California. Available at: https://www.ppic.org/publication/the-sacramento-san-joaquin-delta/

Norström, A. V., Cvitanovic, C., Löf, M. F., West, S., Wyborn, C., Balvanera, P., ... & Österblom, H. (2020). Principles for knowledge co-production in sustainability research. Nature Sustainability, 3(3), 182–190.

Ophir, Y., & Jamieson, K. H. (2021). The effects of media narratives about failures and discoveries in science on beliefs about and support for science. Public Understanding of Science, 30(8), 1008-1023.

Ostrom, E. (1990). Governing the Commons: The Evolution of Institutions for Collective Action. Cambridge University Press.

Rudnick, J., Tomari, K., Dobbin, K., Lubell, M., and Biedenweg, K. 2023 California Delta Residents Survey. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2024-07-01. https://doi.org/10.3886/E195447V2

Sayer, A. (2000). Realism and social science. London: Sage.

Shogren, J. F., Toman, M., & Kask, S. (2010). Behavioral economics and climate policy. In D. R. Nelson, Climate Change and Policy (pp. 131–155). Springer.

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. Science, 185(4157), 1124–1131.

Hyperlinks

[1] https://deltacouncil.ca.gov/social-science

[2] https://deltacouncil.ca.gov/bay-delta-social-science-community-of-practice

[3] https://www.openbookpublishers.com/books/10.11647/obp.0418

[4] https://www.brooketully.com/

[5] https://deltascience.shinyapps.io/Delta_vulnerability_map/

[6] https://www.openicpsr.org/openicpsr/project/195447/version/V2/view;jsessionid=2E19DBE12440F0DBD4FCF4AF3FC7E657

[7] https://sciencetracker.deltacouncil.ca.gov/node/52581

Resource C: Science communication

Introduction

Science communication is vital to addressing each of the grand challenges[1] to Delta science. In a world where future environmental conditions and regulations may look very different and traditional science struggles to keep pace with constant change, we need ways to share the best available science as efficiently and effectively as possible among Delta scientists and decision-makers. Similarly, when Delta communities feel estranged from science and traditional ways of knowing are disconnected from decision-making, we must ensure that science communication is an inclusive exchange of ideas that helps to build trust and create spaces for meaningful engagement and knowledge co-production.

Science communication is a broad, complex, and evolving field that can have multiple meanings for different individuals. At its core, however, it is the process of ensuring that scientific knowledge is not merely produced but is also understood, trusted, and acted upon (Kappel and Holmen, 2019). As such, science communication, as used in the context of the Delta Science Plan, means more than simply publishing academic articles in journals or presenting at conferences. It requires thinking deeply and strategically about the reasons for communicating and how best to engage audiences in ways that support effective decision-making. The Delta Science Program recognizes this need and increasingly encourages research proposals to include a strategic communication and engagement plan. This helps to ensure that science communication is not merely an afterthought.

The purpose of this resource is to: 1) highlight general principles of effective science communication; 2) provide a few examples of Delta-specific audiences and communication methods; and 3) signpost some helpful information for interested readers to learn more. While the resource cannot be comprehensive in every way, we hope it will help advance the conversation about effective science communication in the Delta.

Effective science communication principles

In the words of Braus (2019), effective strategic communication can be boiled down to “getting the right message, through the right media, to the right audience at the right time.” Knowing who your audience is, how scientific research can inform their needs, and your reasons for communicating will generally determine the nature of the message you want to convey and the best method to use for delivery.

Furthermore, it is important to recognize that science communication is an ongoing process of two-way communication, and not something that happens only at the end of a project when you package up and deliver your results.

The three core science communication components—audience, message, and delivery — overlap and interact with each other, and cannot be fully understood in isolation or without context. However, some general principles are worth bearing in mind.

Audience

First, and perhaps most important, identifying and understanding your audience is key. Different audiences have different values, experiences, knowledge, and interests. They also differ in how they like to receive information, who they trust to deliver it, and the sorts of information they are more likely to accept or reject. Listening to and building trust with your audience is vital. When identifying potential audiences, consider who is affected by the topic, who is interested in it, and who can take action. Targeting small, tightly connected groups of people can be more effective than broadcasting to large networks of weak ties (Toomey 2023). Here in the Delta, there are many ways to group audiences. In this resource, we use the following broad groups: scientists, decision-makers, Tribes, and local communities. We will discuss these in more detail in the next section, *Science Communication in the Delta*.

Message

It is also vital to know precisely what you want to communicate, and why. Your message content might be, for example, the factual results of a study, some opinion-based management recommendations, or a solicitation for input. Your reasons for communicating can be similarly varied and may include informing, influencing, or engaging your audience. A good message is clear, concise, relevant, and aligned with the needs and characteristics of your audience. It should avoid unnecessary jargon and not assume too much (or too little) prior knowledge. Storytelling, interactivity, and providing actionable information are often more persuasive than presenting facts alone (Kolandai-Matchett & Armoudian, 2020; Toomey, 2023).

Delivery method

Ultimately, your communication delivery method should align with both the message and the audience. Academic papers and conference presentations are an important medium for scientists; however, decision-makers concerned with policy development may prefer one-page briefs, and lay members of the public may respond better to less formal press, such as podcasts or videos. Interactive approaches, such as ArcGIS StoryMaps or data visualization dashboards, can be suitable for various messages and are accessible in different ways to diverse audiences. More participatory approaches, like community workshops, can be an effective way to engage with and learn from other interested parties. This is part of a broader movement that views effective science communication as an ongoing, two-way exchange of information, rather than a one-way transmission of facts (Druckman et al., 2025).

Science communication in the Delta

Science communication in the Delta is a complex issue. There are myriad producers and consumers of scientific information with multifaceted interests and priorities, belonging to different groups with varying levels of overlap and alignment. It is impossible to keep track of everything that is happening, and the system itself is changing in response to intensifying environmental and social pressures. This Delta-specific complexity overlays the structural challenges of a 21st-century media ecology that is characterized as “post-truth,” hyper-partisan, fractious, and contemptuous of scientific expertise (Druckman et al., 2025). As such, we must work to improve science communication in the Delta. This section will highlight some science communication audiences and delivery methods that are important in the Delta.

Delta audiences

As mentioned earlier, science communication audiences in the Delta can be broadly divided into scientists, decision-makers, Tribes, and local communities. We acknowledge that this categorization is arbitrary and reductive, and that these groups are nebulous and overlapping in nature. However, such groups can be helpful as a structured starting point for considering Delta audiences.

Scientists

- Researchers conducting studies or monitoring activities to address Delta-relevant questions
- Scientists parsing and applying existing scientific research to inform management decisions or policy positions
- People interested in the details of salient bodies of scientific research

Decision-makers

- Professionals who develop and/or implement Delta management policy and may require differing level of scientific detail, viewing it through different lenses, including:
    - Program staff who rely on science to execute everyday operational decisions in the Delta (often referred to as "environmental managers")
    - Lawmakers, policy-level staff, and governing boards concerned with advancing state policy, governance, agency mission, and/or shaping strategic direction
    - Those interested in applied science and what it means for Delta policy and management

Local communities

People or groups with some level of personal relationship to the Delta, who may require less technical and more engaging communication and feel strongly invested in the topic. Their values, knowledge, interests, and other characteristics will vary greatly; psychographic audience segmentation is key. These may include:

- Residents and community groups
- Agricultural interest, commercial interests, and business owners
- Environmental justice or other advocacy groups, interest groups (e.g. duck hunters, fishers, boaters)
- General members of the public

Tribes

- Tribes, tribal communities, and Traditional Knowledge–holders have their own unique knowledge systems, priorities, and decision-making processes
- Federally recognized Tribes are sovereign governments and, as such, are political entities and should not be treated as just an interested party (TEJ Issue Paper, 2025)
- Communication should go beyond "transmitting knowledge" and be an iterative and meaningful process of ongoing engagement and co-production that recognizes the value of Traditional Knowledge and is built on trust, respect, humility, and reciprocity

Delta science communication methods

This section presents some general Delta-relevant communication methods and potential audiences, along with a few specific examples of each method. These examples are merely illustrative and are not intended as a definitive list of communication methods, venues, or approaches in the Delta.

Scientific journals

Historically, peer-reviewed articles in scientific journals have served as the primary means of communicating science to scientific audiences, such as researchers and other scientists. They are also an appropriate vehicle to reach decision-makers who use applied science to direct or otherwise inform their work – most likely program-level managers, but also including policy-focused decision-makers.

- **San Francisco Estuary and Watershed Science**[2] (SFEWS) – open-access journal with a large Bay-Delta science and policy audience; published with support from UC Davis and the Delta Stewardship Council
- **The State of Bay-Delta Science**[3] (SBDS) – periodically released sets of articles synthesizing the science on management-relevant topics (e.g., extreme events in the Delta) to inform decision-making; coordinated by the Delta Science Program, peer-reviewed and published in SFEWS

Conferences

Conferences that focus on applied science and its impact on Delta management and policy may attract a diverse crowd of Delta scientists, decision-makers, and

other interested parties. Such events can facilitate cross-pollination among many groups working in the Delta and catalyze new ideas and collaborations.

- **Bay-Delta Science Conference**[4] (BDSC) – biennial in Sacramento, co-sponsored by the Delta Stewardship Council and the U.S. Geological Survey
- **State of the San Francisco Estuary Conference**[5] – biennial in the San Francisco Bay Area (alternate years to BDSC), organized by the San Francisco Estuary Partnership
- **Delta Science Program and UC Davis Coastal and Marine Sciences Institute joint symposia**[6] – regular free events that synthesize and share the science on a relevant management topic (e.g., microplastics in the Bay-Delta)

Digital platforms

There are numerous online platforms and tools devoted to Delta science communication, many of which are relevant to multiple audiences. Data dashboards and visualizations of management-relevant data (e.g., Shiny applications such as those hosted by the Delta Science Program[7]) are particularly useful because often users can engage with them at several levels: viewing visualizations of pre-selected data, interacting with that data via a graphical interface, or downloading the underlying data to analyze elsewhere. Such tools are extremely valuable for decision-makers, especially those who lack the time or inclination to engage with the science and want actionable information.

- **Flood risk mapping tool**[8] – users can explore flood risk across the Delta in response to specified sea level rise scenarios, and map other data layers of interest, including social vulnerability index and critical infrastructure; produced as part of Delta Adapts[9].
- **Bay Delta Live**[10] – a decision-support tool that federates and displays spatially explicit water and environmental data from hundreds of sources to facilitate analysis, monitoring, reporting, and resource management in the Bay-Delta
- **Delta Science Tracker**[11] – hosts profiles of research and other scientific activities across the Delta to build collaboration and transparency and provide access to associated products (e.g., publications, reports, news articles, fact sheets, and videos); valuable for researchers looking for

collaborators, program managers seeking insight on key topics, policy-focused decision-makers assessing the funding landscape

Policy briefs

Not all Delta science communication is explicitly scientific or technical in nature. Numerous institutions produce policy-focused reports, or higher-level summaries of technical information, that are useful for decision-makers who may be time-limited and focused on synthesizing the big picture from multiple disparate sources.

- **Priorities for California's Water**[12] – well-designed and clearly written policy brief by the Public Policy Institute of California that highlights actionable takeaways for managers and policymakers, includes the right level of information to be understood by informed lay readers, and provides links to further information for readers who need more specifics.

- **SBDS summary sheets**[13] – one-page summaries of SBDS articles that distill the key science and management takeaways for decision-makers, the public, and scientists in other fields

Online media

Online media publications, blogs, and newsletters play a similar role in the science communication ecosystem, delivering a mix of accessible science and policy journalism, as well as explainers, to informed audiences of all types. One particularly useful approach to science storytelling is to use **ArcGIS StoryMaps**– interactive, multimedia communication tools that are surprisingly easy to put together. Another media format that is proving popular for science communication is **podcasting**, which feels less formal and more personal than written or visual media and allows for different consumption patterns.

- **Maven's Notebook**[14] – a comprehensive one-stop shop for California water information, including original and curated news, explainers, podcasts, newsletters, and more; essential reading for anyone involved with the Delta

- **California WaterBlog**[15] – perspectives on California water resources management aimed at policy and educated lay audiences; produced by the UC Davis Center for Watershed Sciences

- **Aquafornia newsletter**[16] – newsletter curating a selection of top water news from California and the West each weekday; produced by the Water Education Foundation
- **Exploring the Heart of California Water**[17] – an informative and engaging StoryMap guide to the Delta that would be an excellent primer for the public, journalists, and non-experts in the policy and legislative realms
- **The Delta Dispatch**[18] – a podcast featuring conversations with experts to help explain the Delta Plan and its policies; produced by the Delta Stewardship Council

Participatory approaches

Finally, participatory public workshops are an increasingly important venue for Delta science communication. Such workshops embrace a new paradigm of science and science communication that centers participation, engagement, and the co-production of knowledge by scientists and the constituents with whom they are communicating. This contrasts with more traditional top-down approaches, which view communication as the transmission of knowledge to less-informed parties to inform, reframe, or correct existing beliefs (Druckman et al., 2025). This bottom-up, participatory process of communication involves building relationships and actively soliciting and incorporating input from interested parties through ongoing dialogue throughout the project. It's essential to acknowledge that these interested parties can be anyone, including local community groups, Tribes, decision-makers, and researchers.

- **Just Transitions in the Delta**[19] – research project that uses public workshops and events, interviews, surveys, and field work to engage with diverse Delta communities and work with them to explore equitable water management strategies under different drought, salinity, and sea level rise scenarios

Conclusion

Science communication is not something that happens only at the end of a project once it is complete and you have some "final" results or other products to share. Instead, it is an ongoing, iterative, and collaborative process pursued in partnership with your audience and those who might benefit from, or be affected by, the outcomes of your project. It requires thinking deeply and with great intentionality about who you are communicating with and why, and the best way to approach

this communication. Indeed, conducting science in an open manner is itself a valuable act of science communication. This process requires listening, flexibility, and intellectual humility, and can help to build trust and shared values within and across Delta communities. As such, it positions science within a matrix of relationships that will help support effective decision-making and enhance the likelihood of effecting meaningful change in the real world.

Resources for further exploration

A small selection of resources to learn more about science communication and the science of communication.

- 2025 Delta Research Engagement and Communication Plan Template[20]
- Reimagining Science Communication in the COVID Era and Beyond[21] (PNAS Special Feature)
- Message framing strategies for effective marine conservation communication[22] (Kolandai-Matchett and Armoudian 2020)
- Communication Approaches and Specialists that Can Improve Fisheries Management[23] (Robison et al., 2024)
- Why facts don't change minds: Insights from cognitive science for the improved communication of conservation research[24] (Toomey 2023)
- Escape from the ivory tower: A guide to making your science matter[25] (Baron 2010)
- COMPASS[26] (including the message box[27], a tool for crafting your message)
- International Association for Public Participation[28]
- Take Action Toolkit | American Association for the Advancement of Science (AAAS)[29]
- Trust in Science - Research and data from Pew Research Center[30]

References

Delta Stewardship Council. (2025). Tribal and Environmental Justice Issues in the Sacramento-San Joaquin Delta: History and Current Perspectives.

https://deltacouncil.ca.gov/pdf/2025-04-24-tribal-and-environmental-justice-in-the-sacramento-san-joaquin-delta-issue-paper.pdf

Druckman, J. N., Ellenbogen, K. M., Scheufele, D. A., & Yanovitzky, I. (2025). An agenda for science communication research and practice. *Proceedings of the National Academy of Sciences*, *122*(27), e2400932122.

Kappel, K., & Holmen, S. J. (2019). Why Science Communication, and Does It Work? A Taxonomy of Science Communication Aims and a Survey of the Empirical Evidence. *Frontiers in Communication*, *4*. https://doi.org/10.3389/fcomm.2019.00055

Kolandai-Matchett, K., & Armoudian, M. (2020). Message framing strategies for effective marine conservation communication. *Aquatic Conservation: Marine and Freshwater Ecosystems*, *30*(12), 2441–2463. https://doi.org/10.1002/aqc.3349

Toomey, A. H. (2023). Why facts don't change minds: Insights from cognitive science for the improved communication of conservation research. *Biological Conservation*, *278*, 109886.

Hyperlinks

[1] https://deltascienceplan.deltacouncil.ca.gov/sites/default/files/2024-11-20-grand-challenges-in-delta-science-essay.pdf

[2] https://escholarship.org/uc/jmie_sfews

[3] https://sbds.deltacouncil.ca.gov/

[4] https://www.baydeltascienceconference.com/

[5] https://www.sfestuary.org/state-of-the-estuary-conference/

[6] https://marinescience.ucdavis.edu/events/cmsi-and-delta-stewardship-council-symposia

[7] https://deltascience.shinyapps.io/Home/

[8] https://deltascience.shinyapps.io/delta_flood_map/

[9] https://www.deltacouncil.ca.gov/delta-plan/climate-change

[10] https://www.baydeltalive.com/home/new-homepage

[11] https://sciencetracker.deltacouncil.ca.gov/

[12] https://www.ppic.org/publication/priorities-for-californias-water/

[13] https://sbds.deltacouncil.ca.gov/sites/default/files/2025-09-19-sbds-information-sheet.pdf

[14] https://mavensnotebook.com/

[15] https://californiawaterblog.com/

[16] https://www.watereducation.org/aquafornia

[17] https://storymaps.arcgis.com/stories/d68f8152af374dbcaf9198f751e18473

[18] https://viewperformance.deltacouncil.ca.gov/index.php/Delta-Dispatch

[19] https://delta-just-transitions-ucdavis.hub.arcgis.com/

[20] https://caseagrant.ucsd.edu/sites/default/files/2025%20DSP%20Engagement%20and%20Communication%20Plan%20Template.docx

[21] https://www.pnas.org/topic/575

[22] https://onlinelibrary.wiley.com/doi/10.1002/aqc.3349

[23] https://academic.oup.com/fisheries/article/49/7/319/7899715

[24] https://www.sciencedirect.com/science/article/pii/S0006320722004396?via%3Dihub

[25] https://islandpress.org/books/escape-ivory-tower#desc

[26] https://www.compassscicomm.org/

[27] https://www.compassscicomm.org/leadership-development/the-message-box/

[28] https://www.iap2usa.org/

[29] https://www.aaas.org/resources/take-action-toolkit

[30] https://www.pewresearch.org/topic/science/trust-in-science/

Resource D: Research funding

Introduction

Increased coordination among funding entities in the Sacramento-San Joaquin Delta (Delta) can improve efficiency, reduce redundancy, and yield greater collective impact. The Delta Stewardship Council's Delta Science Program (DSP) provides a tested and transparent model for aligning science with management needs – one that other funders can adapt or build upon.

Although the Delta Crosscut Budget reported a total of $56.9 million for research and synthesis in FY 2022–2023, DSP contributed only about $4 million. This relatively small share supports high-impact programs, such as the Delta Science Fellows, the Delta Research Awards, and Directed Actions. With the growing need for science and overall funding stagnating, collaboration is no longer optional – it is essential. Working together and leveraging funds creates a larger pool of resources and builds efficiencies to support the research needed to inform decision-making in the Delta.

This resource is primarily intended to inform potential applicants interested in the DSP's research funding opportunities, but also serves as a resource for public agencies and any other organization interested in advancing research in the Delta.

The document outlines the DSP's research funding processes and offers guidance for effective and transparent investments in Delta research. It highlights key considerations for improving coordination among funding entities, strategies for launching or refining funding programs, and a model approach for addressing emerging issues. In addition, it promotes strategies to strengthen the pipeline of researchers working in the Delta.

Delta Science Program process

Funding scientific research is one of the primary ways the DSP fulfills its mission to provide the best possible scientific information to inform water and environmental decision-making in the Delta (Delta Reform Act 2009, Water Code section 85280(b)(4)). The DSP supports research through contracts, which include the Delta Research Awards, the DSP's periodic solicitation process for research in the Delta.

The DSP relies primarily on two pathways to fund research: proposal solicitations and Directed Actions (see sections below for more information). Regular proposal

solicitations are generally considered the most robust and transparent way to fund research, providing a predictable source of funds for high-priority research in the Delta. Therefore, most of DSP's budget is allocated for competitive research. The best approach will depend on the availability of funds, the urgency of the information needed, and the specificity of the research questions. This flexibility enables the DSP to address both long-term planning needs and time-sensitive management questions.

The Delta lead scientist plays a central role in guiding the competitive research process, including:

- Providing scientific advice on the content of solicitations
- Providing scientific advice on prioritizing proposed Directed Actions
- Advising on the selection of expert reviewers and leading review panels
- Advising on awards based on independent scientific review
- Advising on science funding priorities

All proposals undergo both administrative and scientific peer review, with all reviewers screened for potential conflicts of interest (see Resource E: *Conflict of interest process for reviewers, advisors, and applicants* for details). This rigorous, transparent process ensures accountability and the integrity of funded research.

In recent years, the DSP has increasingly emphasized interdisciplinary approaches and the inclusion of social science, traditional ecological knowledge (TEK), and co-production of knowledge – collaborative processes that involve scientists, managers, and community members in all phases of research. These approaches improve the relevance, credibility, and application of scientific findings.

Despite the strengths of DSP research funding, gaps remain. The DSP does not currently offer grants, which can be a more flexible and efficient mechanism for research. There is also limited capacity to respond rapidly to emerging issues due to the lack of funds and the time required to execute contracts. Additional funds are needed to support adaptive management, synthesize existing research, communicate findings, and coordinate science investments across agencies. Establishing regular funding coordination meetings and expanding convening roles could strengthen system-wide collaboration and improve strategic alignment of science funding in the Delta.

Proposal solicitations

The DSP manages a competitive process to distribute research funding when science needs are broad and crosscutting, as identified in the Science Action Agenda (SAA). The SAA acts as the unifying framework, or the "glue", that brings together efforts across the Delta by identifying and prioritizing management-relevant science needs. The DSP is often able to strategically fill critical science gaps that other funding programs may overlook.

Funding may originate from various sources, including federal and state agencies, as well as other public entities. Each source often comes with unique constraints, such as indirect cost caps, specific focus areas, and eligibility requirements that must be considered during solicitation development and implementation.

To ensure alignment with funding priorities and to expand support for high-quality research, funding partners are actively engaged during both the planning and selection phases. DSP solicitations always receive more proposals than the DSP can fund, so funding partners are encouraged to support proposals that align with their specific priorities within the SAA and financial capabilities. This approach increases the total number of funded projects and streamlines the solicitation process by reducing the need for separate efforts by each funding partner.

All proposals must be submitted in accordance with the official solicitation instructions. Each proposal undergoes an independent external scientific review to ensure transparency, rigor, and merit-based selection.

A critical component of this process is the partnership with third-party academic institutions, such as California Sea Grant. These partners can not only manage the online application portal and administer awarded funds but also help facilitate a more robust and independent review process.

Review of Proposals

Figure D-1. Five-step process for the Delta Research Awards: (1) Call for proposals based on the Science Action Agenda, (2) Individual reviews by multiple subject matter experts, (3) Panel review led by the Delta lead scientist, (4) Award consultation with the lead scientist, and (5) Final award selection by the Delta Stewardship Council.

DSP typically posts a draft solicitation notice online for public comment, engages in related outreach, and *may* offer some assistance in facilitating research collaborations where permissible. To facilitate the review process, DSP typically requires a Letter of Intent before the full proposal stage. Eligible proposals are distributed to subject matter experts for scientific review.

Directed actions

Directed Actions are appropriate when one individual or team is qualified to do the work, scientific research or advice is needed quickly, or when an important opportunity would be lost if the proposal had to wait for the standard competitive proposal solicitation. This approach is similar to the National Science Foundation's "Rapid Response Grants" process. They may be procured on a non-competitive basis, as permitted by law.

Because Directed Actions are time-sensitive, approved proposals will be funded as quickly as possible, when funds are available. Projects should be low-cost, high-impact, and typically last less than two years.

Directed Actions are generally categorized into the following groups based on the needs they address:

- **Rapid Response:** Urgent investigations launched in response to unusual or extreme events to quickly gather data and enhance understanding for timely decision-making in the Delta
- **Collaborative Science:** Science efforts that address pressing needs identified by interagency and collaborative groups, often outside the typical solicitation timeline
- **Novel Technology or Expertise:** Critical research that leverages unique or exclusive expertise or technology to explore innovative solutions
- **Broadening Opportunity:** Aims to improve equity in science funding by supporting underrepresented organizations or individuals through targeted projects, internships, or scholarships

Review and decision process

Delta Stewardship Council staff consult with the Delta lead scientist to determine whether a project idea aligns with the SAA and fits into one of the Directed Action categories. The Delta lead scientist determines whether, based on scientific considerations, the urgency and topic of the proposed research merit further consideration. Directed Action proposals are evaluated based on several criteria, including:

- Availability of funds
- Urgency and uniqueness of the project
- Scientific and technical merit
- Improvement to Bay-Delta knowledge
- Relevance to management or policy
- Collaborative and transparent proposal process with broad participation

The proposal will be reviewed according to the above criteria by a group that includes:

- One discipline-relevant external academic subject matter expert
- A federal, state, or public agency subject matter expert with direct knowledge of the relevance of the activity
- One or more Delta Stewardship Council DSP subject matter expert(s)
- One Delta Stewardship Council Planning & Performance Measures Division subject matter expert

To be considered, a proposal must receive an average reviewer score greater than three out of four. Based on independent reviews, the Delta lead scientist may request revisions to the proposal. If the requested revisions are significant, the proposal may undergo a second round of review, generally with the same reviewers if they are available.

Resource E: Conflict of interest process for reviewers, advisors, and applicants

Introduction

As part of its mission to provide the best available scientific information to inform water and environmental decision-making in the Delta, the Delta Science Program (DSP) takes steps to ensure the integrity of its work products and processes. The DSP is committed to transparency and strives to ensure consistency among the funding agencies with which it coordinates and collaborates.

This overview of DSP's conflict of interest (COI) process is guided by state law and intended to prevent actual and perceived conflicts of interest that could undermine the integrity of DSP-funded science. This process extends to actions or activities that could create the perception of bias, favoritism, influence, or unfair funding decisions.

A potential conflict of interest does not automatically disqualify an individual or organization from working with the DSP and may sometimes be managed through disclosure.

Situations that may have conflict of interest implications include:

- Submitting a bid, proposal, or application
- Reviewing proposals or applications
- Advising the Delta Stewardship Council
- Subject matter experts conducting peer review

Table E-1. *Summary of Conflict-of-Interest Laws and Regulations (this summary is for illustrative purposes only and is not intended to provide legal advice or interpretation or be representative of all potentially applicable laws)*

Law	**Summary**
Government Code section 87100	Public officials must not make or influence decisions if they have a financial interest in the outcome of those decisions.

Government Code section 8920	High-level state officials must avoid actions that conflict with their personal or financial interests with their public responsibilities.
Incompatible activities: GC 1125; GC 19990	State employees are prohibited from engaging in outside work or activities that conflict with their official duties or create a potential conflict of interest.
Government Code section 1090	Officials and employees are prohibited from participating in the making of contracts if they or their agency has a financial interest in them.
Public Contract Code section 10365.5	If you have a consulting contract to help develop a plan or recommendation, you cannot then bid on work that stems from or is suggested by that plan.
Public Contract Code section 10410	State employees cannot be paid for work funded by the state unless it's part of their job, and they cannot independently contract with the state while still employed.
Public Contract Code section 10411	Former state employees are prohibited from entering into contracts related to their state service for a period of two years after leaving their state job. For one year after leaving a policymaking position, former employees are prohibited from contracting with their former agency in the same subject area, unless it's for expert witness or ongoing legal work.

Proposal and independent peer review

The DSP contracts with independent experts to serve as peer reviewers for research proposals and scientific materials. To avoid financial, professional, and personal conflicts of interest or the perception of conflicts, the DSP selects reviewers who have no direct connections or perceived connections to the proposals that they review.

Independent peer reviewers are considered consultants and compensated through consulting services contracts. These contracts require reviewers to operate through businesses authorized to work in California and comply with applicable laws and

regulations. In some cases, the contracts may be subject to additional requirements and restrictions under the Political Reform Act (see 'Advising the Delta Stewardship Council' section below).

Because potential conflicts of interest are not always apparent, the DSP expects potential reviewers to promptly disclose any direct or indirect financial, professional, personal, or other connection to proposals under review. The DSP uses this information to assess whether that reviewer is suitable to participate in the review of that specific proposal.

A reviewer is disqualified if they:

- Assisted in the development of the proposal to be reviewed in any way
- Will receive a direct or indirect (e.g., income, cost recovery/avoidance) financial benefit from the funded project
- Have a conflict of interest under California law (see e.g., Conflict of Interest Law and Regulations table above)

In addition, a reviewer may be disqualified if they have any of the following connections to a proposal applicant within the past four years:

- Collaboration on research
- Co-authorship of publication(s)
- Thesis or post-doctoral advisor/advisee relationship
- Supervisor/employee or independent contractor relationship
- Worked at the same federal, state, or local agency; university; or private firm – even if they are in different divisions
- A close personal relationship

These connections do not necessarily disqualify the reviewer. The submitted information regarding such connections in the proposal is reviewed to determine if the connections could compromise the objectivity of the reviewer. If any disclosed connection may result in bias, favoritism, or an unfair funding decision, the reviewer will be excluded from that proposal or review, and the DSP will reassign the proposal or review. Additionally, individuals selected to serve as reviewers are expected to complete unconscious bias training before the review.

Advising the Delta Stewardship Council

Serving as an advisor to the Delta Stewardship Council or the DSP may affect eligibility for future funding or contract opportunities related to the advice provided. Individuals or organizations that participate in the Delta Stewardship Council or DSP workgroups, committees, or advisory panels may be considered advisors under state conflict of interest rules, even if the role is unpaid or informal.

Examples of situations that may lead to ineligibility include:

- Providing input on topics or priorities for funding program(s)
- Independent scientific advice that provides direct recommendations for public policy
- Participation in Delta Stewardship Council committees or work groups that inform Delta Stewardship Council policy or its implementation (e.g., Delta Adapts and/or Environmental Justice Initiative)

Individuals and organizations engaged in these roles should evaluate potential for advisory conflicts before submitting proposals. Early disclosure of participation in any Delta Stewardship Council committee or workgroup that advised on funding topics or priorities is strongly recommended to determine if participation could affect eligibility.

Resource F: Science governance and the collaborative Delta science-scape

Introduction

This resource provides an updated network analysis of the leading collaborative science venues in the Delta. A diagram of this network was first included in the 2019 Delta Science Plan to serve as a tool for understanding and improving collaborative science governance in the Delta. Revisiting and reanalyzing the network enables an exploration of how the Delta's science landscape has changed in the intervening years. Future analyses of this updated network could include identifying changes in the engagement of different types of organizations, changes in venues and their scopes, and strategies for effectively governing future science in the Delta in a rapidly changing world.

Collaborative science governance

In a complex social-ecological system like the Delta, governance is not about one individual or organization making a decision but rather multiple individuals within organizations and systems of linked organizations making decisions to advance the collective good. **Collaborative governance** refers to the processes and structures of public policy decision-making and management that engage people constructively across the boundaries of public agencies, levels of government, and/or the public, private, and civic spheres to carry out a public purpose that could not otherwise be accomplished (Emerson et al., 2012).

Collaborative science governance is a form of governance that strives to collectively prioritize research questions, determine how science is conducted, and review and distribute the results. Collaborative science governance encompasses a range of science activities, including the direction of funding to research programs aimed at achieving high-priority science goals, the establishment and communication of best practices for carrying out research, and the review and dissemination of science results to decision-makers and other users. The network analysis described here focuses on the organizations involved in collaborative science governance as a first step.

Selecting collaborative science venues

This resource maps out the network of connections between 13 formal, collaborative Delta science venues; however, it is important to state that more than 13 venues conduct collaborative science in and around the Delta, and this network does not represent the complete picture. Before diving into the analysis further, it is helpful to define how these particular venues were selected, which will provide some clarity.

While crafting this network analysis, the keywords "**main**, **active, collaborative science** venues in the **Delta**" provided meaningful guidance. Each bolded word served a purpose in deciding which venues to highlight.

Main: Although many venues are actively engaged in important collaborative science in the Delta, including all active venues, a network diagram that is too large or illegible to be useful would be produced. As such, venues with more connections (and especially more connections to central, core organizations) were prioritized over venues with fewer connections for this analysis.

Active: Each venue included in this analysis is actively meeting as of the production of the resource. One exception is CSAMP/CAMT, which is on pause as of Fall 2025 but expected to resume. Some venues included in the previous analysis are no longer active, while others have emerged or become more active in the Delta from the last analysis, resulting in some changes to the represented venues. Table F-2 shows these changes in venue representation.

Collaborative: Venues needed to include multiple, varied parties. For example, a research project localized to a single agency or research institution would not qualify.

Science: The primary function of each venue needed to be conducting, utilizing, or supporting science, although the type or scope of science activities could, and did, vary. Venues with other primary functions, such as management or community engagement, serve critical roles in this system, but not the role that was being prioritized in this analysis.

Delta: The Delta needed to be a primary focus of work for each collaborative science venue. Venues with a significant emphasis on the Delta were prioritized over those in which the Delta was only a small part of their scope, or where only a portion of the Delta was included.

By using these keywords to guide venue selection, the analysis focused on 13 venues, which are detailed in Table F-1.

Identifying venue participants

The Delta science-scape network is composed of two types of entities (or nodes):

1. Venues: the collaborative science venues where multiple organizations engage in science governance, that is, organizations that coordinate activities, develop research goals, and select the means to meet those goals, and/or synthesize, review, and communicate the results

2. Organizations: the collection of government and interested party organizations participating in these venues, classified by type of organization

The Interagency Ecological Program (IEP) is unique in that it serves as both a venue and an entity participating in other venues; therefore, it is counted in this analysis as both a venue and a participating organization.

Due to each collaborative science venue having a different governance structure, the process of identifying its regular participants varied slightly from venue to venue. In general, participating agencies and organizations were listed on each venue's website, but not in every case. In addition, some venues have a primary group of member organizations that participate consistently, while others are open to interested parties rotating in and out of attendance. Finally, some venues have multiple workgroups guided by a central Steering Committee, while others do not have any separate workgroups. To accommodate these varying structures, numerous resources were used to identify regular participants in each venue, including:

- Member/participant lists on venue websites

- Meeting notes, publications, or other publicly available documents from venues

- Conversations with venue coordinators, directors, or other key points of contact

For the most part, all participants who were identified were included in the network analysis. However, there were two cases in which decisions were made:

- For venues with multiple work groups, teams, or subcommittees guided by a central Steering Committee, the members of the Steering Committee were utilized as the central participants of those venues
- If organizations had participated in a venue in the past but had not regularly participated in the last two years, they were not included in the 2025 analysis

The goal in both cases was to prioritize the most central and consistent participants of these venues, aligning with the priority established in the previous section to highlight the most central venues overall. Although every effort was made to represent the central venues and participants in this network accurately, this is a dynamic system, and not all elements may be captured at the time of analysis.

Collaborative science participants

Participants were sorted into one of ten categories, which are bolded below, color-coded in the network diagrams, and further explored in Tables F-3 and F-4. Throughout this resource, references are made to the "full network" and the "core network." The entire network comprises the whole list of participants involved in at least one venue; the core network, on the other hand, contains only the participants engaged in more than one venue.

The primary actors in the Delta science network are federal and state agencies with responsibilities towards water supply, water quality, wildlife management, and habitat restoration. One or more **federal agencies** are present in every venue, with a total of ten federal agencies in the whole network and six agencies in the core network. The six federal agencies in the core network are the National Marine Fisheries Service (NOAA Fisheries), the U.S. Army Corps of Engineers, the U.S. Bureau of Reclamation, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, and the U.S. Geological Survey. One or more California **state agencies** are present in every venue, with a total of 20 state agencies involved, including nine core agencies. The nine California state agencies in the core network are the Department of Fish and Wildlife, Department of Food and Agriculture, Department of Parks and Recreation/State Parks, Department of Water Resources, Delta Protection Commission, Delta Stewardship Council, Sacramento-San Joaquin Delta Conservancy, San Francisco Bay Conservation and Development Commission, and the State Water Resources Control Board.

Many city and county government actors participate in the network and are categorized as **general local agencies**. In some cases, a county may have

representatives from different parts of its government in separate venues, such as the County of Solano participating in one venue and the Solano County Agricultural Commissioner's Office participating in another. Where possible, these differing parts of one county's government were counted as the county – in this case, Solano County – so that the county could be represented in the core network as a participant in multiple venues. One exception to this process is **special water districts**, which are categorized separately from other local agencies to reflect their specialized functions. They perform at least one of four specific duties: water delivery, waste disposal/sanitation, flood management, and water conservation. These districts may participate in the network individually or be represented by larger member associations, such as the Metropolitan Water District of Southern California (Metropolitan) or the State Water Contractors (SWC).

11 **tribal entities** participate in the whole network, a significant increase from the two tribal entities included in the previous analysis (the Hoopa Valley and Yurok Tribes). However, since each of these tribal entities is included in only one venue, none are included in the core network diagram.

A wide variety of other actors participate in the collaborative science venues. **Nongovernmental organizations and community groups** represent people such as fishermen, agricultural communities, and local community members, and issues including, but not limited to, habitat restoration and wildlife conservation. Academic institutions and research-oriented organizations are categorized under **the Research category**. Numerous **consultants** are involved in various venues, and the organizations listed as **consortia** are collaborations between different types of agencies & organizations, such as the San Francisco Estuary Partnership (SFEP). Finally, one **private company,** Wonderful Orchards, is included. A complete list of entities included in the analysis can be found in the Glossary of Acronyms.

Table F-1. The 13 central collaborative science and policy venues in the Delta.

Acronym	Full Name	Role/purpose	Primary participants
CAWQMC	California Water Quality Monitoring Council	Develop specific recommendations to improve the coordination and cost-effectiveness of water quality and ecosystem monitoring and assessment, enhance the integration of monitoring	Federal and state entities, citizen monitoring groups, the public, and scientific, agricultural, regulated water, and

		data across departments and agencies, and increase public accessibility to monitoring data and assessment information	water supply communities
COEQWAL	Collaboratory for Equity in Water Allocations	Build an open, collaborative modeling and engagement space to explore Delta water futures; compare scenario outcomes with fixed, equity-oriented thresholds; synthesize and communicate results to inform adaptive management and fair decision-making across agencies, Tribes, communities, and water managers	Multiple University of California campuses and California State University Sacramento, working in partnership with state and federal government agencies, Native American tribes, community groups, water districts, and NGOs
CoP	Bay-Delta Social Science Community of Practice	Bring together social science scholars, practitioners, and allies who are committed to advancing applicable and relevant research on the human dimensions of the Bay-Delta. Facilitate collaborative social science research and interdisciplinary investigation, provide opportunities for the social sciences to inform management and policy, and advance our understanding of the	The CoP is coordinated by the Delta Stewardship Council's Social Science Integration Team, and is open to social science scholars, practitioners, and allies across the San Francisco Bay and Sacramento-San Joaquin Delta system

		estuary as a complex social-ecological system	
CSAMP/ CAMT	Collaborative Science and Adaptive Management Program/Collaborative Adaptive Management Team	Collaboratively produce information and evaluate science and management actions associated with the protection of species of concern and actions related to the State Water Project and Central Valley Project to improve the performance of ecological systems and water supply	Federal and state entities and interested parties involved in the court-ordered remand schedule for completing revisions to the Delta Smelt and salmonid Biological Opinions (2008 and 2009 BiOps)
CWEMF	California Water and Environmental Modeling Forum	Increase the usefulness of models for analyzing California's water-related problems, facilitate the exchange of information, resolve technical disagreements, and ensure that technical work considers the interests of the parties and management needs Also, a non-partisan clearing house for models and peer review	Federal and state entities, other entities with interests in water, universities, environmental organizations, private consultants, and the general public (over 100 individual member entities)
DIISC	Delta Inter-agency Invasive Species Coordination Team	Foster communication and collaboration among California state agencies, federal agencies, research and conservation groups, and other interested parties that detect, prevent, and manage invasive	California state agencies, federal agencies, research and conservation groups, and other interested parties

		species and restore invaded habitats in the Sacramento-San Joaquin Delta	
DPIIC	Delta Plan Interagency Implementation Committee	DPIIC strives to facilitate Delta Plan implementation through collaboration in support of shared national, statewide, and local goals for the Delta	18 federal and state entities are involved in the Delta Plan implementation
Delta RMP	Delta Regional Monitoring Program	Better inform decisions on protecting and restoring beneficial uses of water by producing objective and cost-effective scientific information critical to understanding regional water quality conditions and trends in the Delta	Federal and state agencies, cities in and around the Delta, special water districts and other relevant districts, and water quality coalitions
IAMIT	Interagency Adaptive Management Integration Team	Work in support of integrated adaptive management for ecosystem restoration and water management in the Yolo Bypass, Delta, and Suisun Marsh	Federal, state, and local entities, and interested parties involved in planning, funding, implementing, or that have regulatory oversight of Delta habitat restoration projects
IEP	Interagency Ecological Program	Provide and integrate relevant and timely ecological information for management of the San Francisco Bay-Delta	Nine federal and state entities

		ecosystem and the water that flows through it. This task is accomplished through collaborative and scientifically sound monitoring, research, modeling, and data synthesis	
ITAG	Interagency Telemetry Advisory Group	To achieve a reliable coordinated acoustic telemetry program that leads to improved monitoring of several aquatic species of the California Central Valley (e.g., Chinook salmon, Steelhead, Sturgeon)	8 federal and state agencies, two University of California campuses, and EBMUD
SIT	CVPIA Science Integration Team	The SIT is a collaborative technical team composed of interested parties and scientists who use the structured decision-making process to support adaptive resource management for CVPIA Fish Resource Area activities.	A self-selected technical group of federal & state agency staff, academic researchers, and interested parties
WRMP	San Francisco Estuary Wetlands Regional Monitoring Program	Delivers coordinated regional monitoring of the San Francisco Estuary's wetlands to inform science-based decision-making for wetland restoration and adaptive management and increase the cost-effectiveness of permit-driven monitoring	Federal and state agencies, community and conservation organizations, and interested parties in the San Francisco Estuary restoration community

		associated with wetland restoration projects.	

Note: This table includes only 13 central, ongoing Delta collaborative science venues and is not an exhaustive list of all collaborative Delta science activities.

Table F-2. Changes in the venues included in the network analysis.

Currently inactive venues that were not included in the 2025 analysis	Venues that are new to the 2025 analysis
Interagency Implementation and Coordination Group (IICG)	Collaboratory for Equity in Water Allocations (COEQWAL)
Integrated Modeling Steering Committee (IMSC)	Bay-Delta Social Science Community of Practice (CoP)
Nutrient Stakeholder and Technical Advisory Group (Nutrient STAG)	CVPIA Science Integration Team (SIT)
	San Francisco Estuary Wetlands Regional Monitoring Program (WRMP)

Science-scape network diagrams and a summary of relationships

The network models below (Figures F-1 and F-2) were created by compiling a list of the 13 major collaborative Delta science venues (see Table F-1) along with the list of participating organizations for each venue. This data was analyzed in R by creating a network, where each organization formed a node and the connections between the venues and their participants formed the edges between nodes. This analysis does not account for the nature of these relationships (e.g., whether one organization informs another, or any hierarchical relationships).

Figure F-1 is a diagram of the entire network, which includes the 13 collaborative venues and all organizations that participate in at least one of these venues. This is the “big picture” network and shows the full range of 194 participants.

Figure F-2 shows the collaborative science core network. This network was formed by excluding organizations that participate in only one collaborative venue, assuming they are more peripherally involved. The resulting core network of 47

organizations affords a more focused examination of the set of organizations embedded in the collaborative Delta science system. Although many venues share similar organizational participants, the venues differ in scope and role. Identifying shared participants may provide insights, such as how information is shared among different groups. It also provides a basis for comparison that reveals which venues involve heavily coordinated actors versus those that provide a point of engagement for the broader collaborative Delta science community.

One measure of influence in a network is known as *degree centrality*, which is defined as the number of links that connect a given node to other nodes in the network. The more connections an organization has, the higher its degree, and the closer the organization moves towards the center of the network. For venues, the closer their participants are to the center, the closer the venue itself moves towards the center. The very center of the diagram is composed of the organizations involved in the highest number of venues (mostly state and federal agencies) and the venues whose membership is primarily comprised of those central nodes. One important note is that a venue's degree of centrality does not represent its importance. The more peripheral venues provide much-needed opportunities for a larger web of organizations to participate in Delta science, such as community groups, tribal entities, and local government agencies, who are not as well-represented in the center of the network.

Table F-3 provides the number of organizations participating in the entire network and the core network, as well as the average number of venues in which each type of organization is involved. Federal agencies are the most central sector in the network. Each of the nine federal agencies in the whole network participates in an average of 5.1 venues, and the six federal agencies in the core network participate in an average of 7.2 venues. State agencies are the next most central sector, with each of the 20 state agencies in the whole network participating in an average of 3.0 venues, and each of the nine state agencies in the core network participating in an average of 5.3 venues. By contrast, only five of the 34 general local government agencies participate in more than one collaborative venue. Of the 20 special water districts in the system, only four participate in more than one venue. As mentioned earlier, although 11 tribal entities are included in the entire network, none are included in the core.

Table F-4 outlines the number of participants in each venue for both the full and core networks. Some venues have a small number of participants, all of whom are in the core network, while at the other end of the spectrum, some venues have a large number of participants, very few of whom are in the core network. The

venues that attract a large number of participants not in the core network may be the only places where select organizations participate, providing an important point of entry into Delta science governance.

Delta Science Tracker

Since the production of the last network analysis, a new tool has been published that enables interactive exploration of collaborative science in the Delta: the Delta Science Tracker[1]. The Delta Science Tracker provides a window into current, past, and future research projects in the Delta, as well as the collaborations that bring these projects to life. The Science Tracker can create network diagrams similar to the diagrams included in this resource, and the data can be downloaded for further analysis. Researchers involved in research in and around the Delta are invited to contribute to the Delta Science Tracker to ensure that the Science Tracker is up-to-date and complete. To contribute, email ScienceTracker@deltacouncil.ca.gov.

Conclusions

This resource aims to provide a valuable tool for understanding both the current state of the Delta's collaborative science landscape and its evolution since the last analysis was conducted. Some venues that were present in the previous analysis were excluded from the current analysis due to inactivity, while new venues were included to reflect their active participation and contributions to the world of collaborative science in the Delta. Just as the venues have changed, so have the participants, with some no longer being represented and others joining the system. This analysis presents a dual opportunity to look back and reflect on these changes, and forward to ask new questions motivated by what has been learned over the last six years.

Further investigations could use these updated analyses to explore various questions about science governance in the Delta, such as how the scopes and responsibilities of the venues in the system have changed, how engagement of different communities has increased or decreased, and where funding or research attention could be directed to ensure that science governance is being addressed as effectively as possible in the increasingly complicated social-ecological system of the Delta.

Figures

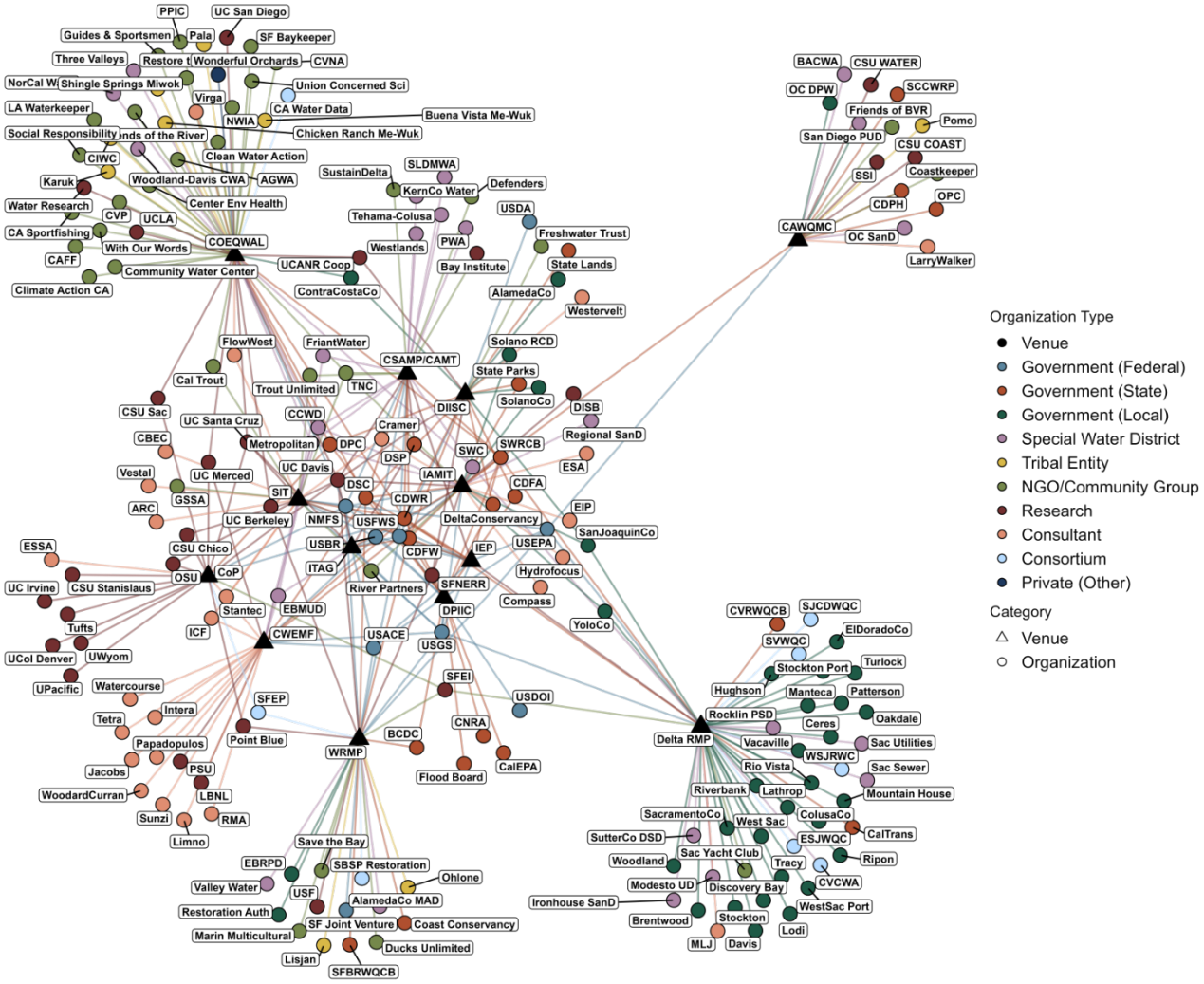


Figure F-1. *The Delta science governance complete network, showing the main 13 Delta science collaborative venues (triangles) and all of the organizations (circles) that participate in at least one of the selected venues. Both organizations and venues are more centrally located in the diagram, the more connections they have. See Glossary of Acronyms on pages for full names of venues and organizations.*

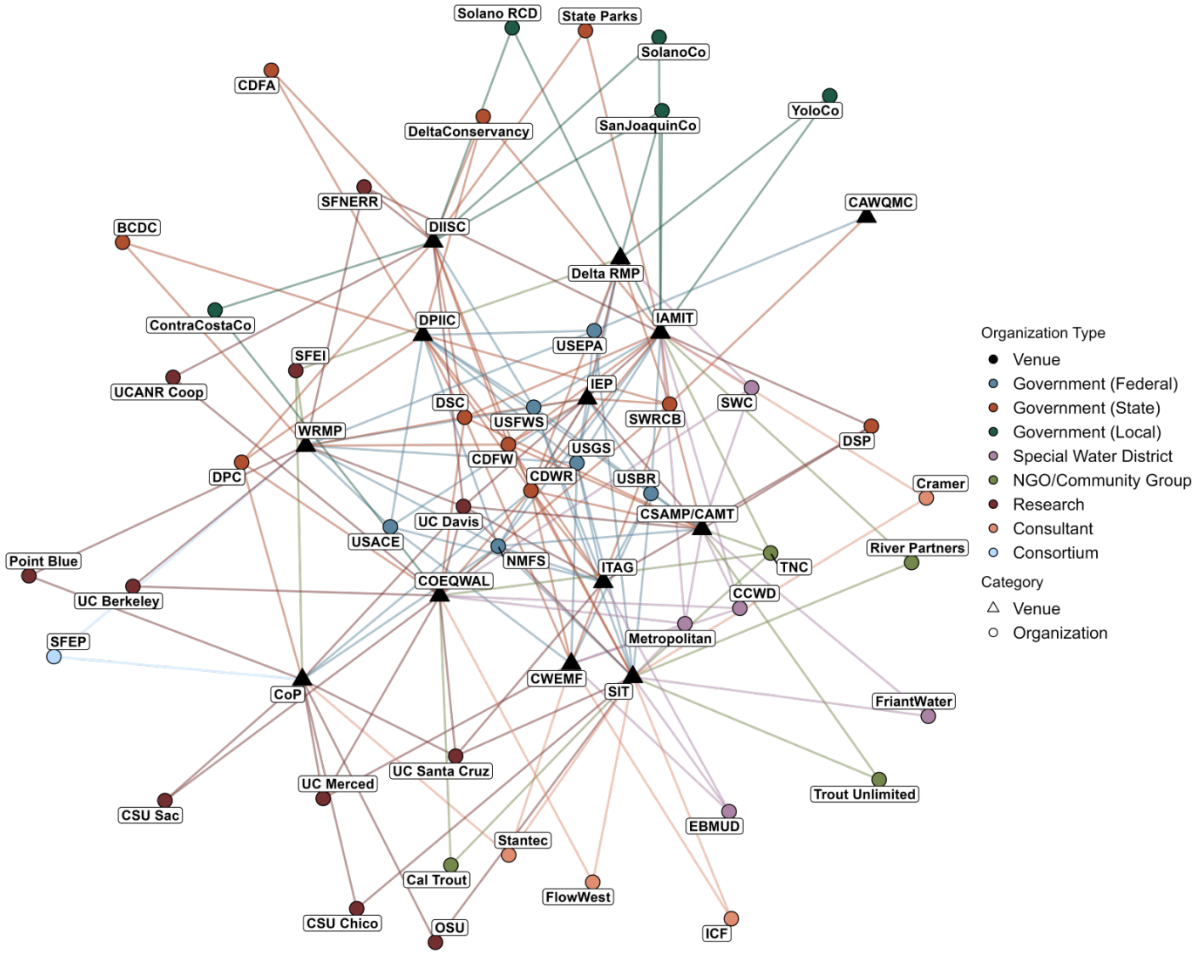


Figure F-2. *The Delta science governance core network. This network diagram illustrates each of the 13 main collaborative science venues and the organizations that participate in more than one of the selected venues. See Glossary of Acronyms below for full names of venues and organizations.*

Glossary of acronyms

AGWA: Alliance for Global Water Adaptation	AlamedaCo: County of Alameda
AlamedaCo MAD: Alameda County Mosquito Abatement District	ARC: Aquatic Resource Consulting
BACWA: Bay Area Clean Water Agencies	Bay Institute: The Bay Institute
BCDC: Bay Conservation & Development Commission	Brentwood: City of Brentwood
Buena Vista Me-Wuk: Buena Vista Rancheria of the Me-Wuk Indians	Friends of BVR: Friends of Buena Vista Reservoir

CA Sportfishing: California Sportfishing Protection Alliance	CA Water Data: California Water Data Consortium
Water Research: California Water Research	CAFF: Community Alliance with Family Farmers
Cal Trout: California Trout	CalEPA: California Environmental Protection Agency
CalTrans: California Department of Transportation	CAWQMC: California Water Quality Monitoring Council
CBEC: CBEC Eco Engineering	CCWD: Contra Costa Water District
CDFA: California Department of Food and Agriculture	CDFW: California Department of Fish and Wildlife
CDPH: California Department of Public Health	CDWR: California Department of Water Resources
Center Env Health: Center for Environmental Health	Ceres: City of Ceres
Chicken Ranch Me-Wuk: Chicken Ranch Rancheria Me-Wuk Indians	CIWC: California Indian Water Commission
Clean Water Action: Clean Water Action	Climate Action CA: Climate Action California
CNRA: California Natural Resources Agency	Coast Conservancy: California State Coastal Conservancy
Coastkeeper: Orange County Coastkeeper	COEQWAL: Collaboratory for Equity in Water Allocations
ColusaCo: County of Colusa	Community Water Center: Community Water Center
Compass: Compass Resource Management	ContraCostaCo: County of Contra Costa
CoP: Bay-Delta Social Science Community of Practice	Cramer: Cramer Fish Sciences
CSAMP/CAMT: Collaborative Science and Adaptive Management Program/Collaborative Adaptive Management Team	CSU Chico: California State University, Chico
CSU COAST: California State University - Council on Ocean Affairs, Science & Technology	CSU Sac: California State University, Sacramento

CSU Stanislaus: California State University, Stanislaus	CSU WATER: California State University - Water Advocacy Towards Education and Research
CVCWA: Central Valley Clean Water Association	CVNA: Central Valley Neighborhood Harvest
CVP: Central Valley Partnership	CVRWQCB: Central Valley Regional Water Quality Control Board
CWEMF: California Water and Environmental Modeling Forum	Davis: City of Davis
Defenders: Defenders of Wildlife	Delta RMP: Delta Regional Monitoring Program
Delta Conservancy: Sacramento-San Joaquin Delta Conservancy	DIISC: Delta Inter-agency Invasive Species Coordination Team
DISB: Delta Independent Science Board	Discovery Bay: Town of Discovery Bay
DPC: Delta Protection Commission	DPIIC: Delta Plan Interagency Implementation Committee
DSC: Delta Stewardship Council	DSP: Delta Science Program
Ducks Unlimited: Ducks Unlimited	EBMUD: East Bay Municipal Utility District
EBRPD: East Bay Regional Park District	EIP: Ecosystem Investment Partners
ElDoradoCo: County of El Dorado	ESA: Environmental Science Associates
ESJWQC: East San Joaquin Water Quality Coalition	ESSA: ESSA Technologies Ltd
Flood Board: Central Valley Flood Protection Board	FlowWest: FlowWest
Freshwater Trust: The Freshwater Trust	FriantWater: Friant Water Authority
Friends of the River: Friends of the River	GSSA: Golden State Salmon Associates
Guides & Sportsmen: Nor-Cal Guides & Sportsmen's Association	Hughson: City of Hughson
Hydrofocus: HydroFocus, Inc.	IAMIT: Interagency Adaptive Management Integration Team
ICF: ICF Consulting	IEP: Interagency Ecological Program
Intera: INTERA, Inc.	Ironhouse SanD: Ironhouse Sanitary District
ITAG: Interagency Telemetry Advisory Group	Jacobs: Jacobs Engineering
Karuk: Karuk Tribe	KernCo Water: Kern County Water Agency

LA Waterkeeper: LA Waterkeeper	Larry Walker: Larry Walker Associates
Lathrop: City of Lathrop	LBNL: Lawrence-Berkeley National Labs
Limno: LimnoTech	Lisjan: Confederated Villages of Lisjan
Lodi: City of Lodi	Manteca: City of Manteca
Marin Multicultural: Multicultural Center of Marin	Metropolitan: Metropolitan Water District of Southern California
MLJ: MLJ Environmental	Modesto UD: City of Modesto Utilities Department
Mountain House: City of Mountain House	NMFS: National Marine Fisheries Service/NOAA Fisheries
NorCal Water: Northern California Water Association	NWIA: National Women in Agriculture
Oakdale: City of Oakdale	OC DPW: Orange County Department of Public Works
OC SanD: Orange County Sanitation District	Ohlone: Association of Ramaytush Ohlone
OPC: Ocean Protection Council	OSU: Oregon State University
Pala: Pala Tribe	Papadopulos: S.S. Papadopulos & Associates, Inc.
Patterson: City of Patterson	Point Blue: Point Blue Conservation Science
Pomo: Big Valley Band of Pomo Indians	PPIC: Public Policy Institute of California
PSU: Portland State University	PWA: Public Water Agencies Group
Regional SanD: Sacramento Regional County Sanitation District	Restoration Auth: San Francisco Bay Restoration Authority
Restore the Delta: Restore the Delta	Rio Vista: City of Rio Vista
Ripon: City of Ripon	River Partners: River Partners
Riverbank: City of Riverbank	RMA: Resource Management Associates
Rocklin PSD: City of Rocklin Public Services Department	Sac Sewer: Sacramento Area Sewer District
Sac Utilities: City of Sacramento Department of Utilities	Sac Yacht Club: Sacramento Yacht Club
SacramentoCo: County of Sacramento	San Diego PUD: City of San Diego Public Utilities Department
SanJoaquinCo: County of San Joaquin	Save the Bay: Save the Bay
SBSP Restoration: South Bay Salt Ponds Restoration Project	SCCWRP: Southern California Coastal Water Research Project

SF Baykeeper: San Francisco Baykeeper	SF Joint Venture: San Francisco Bay Joint Venture
SFBRWQCB: San Francisco Bay Regional Water Quality Control Board	SFEI: San Francisco Estuary Institute
SFEP: San Francisco Estuary Partnership	SFNERR: San Francisco Bay National Estuarine Research Reserve
Shingle Springs Miwok: Shingle Springs Band of Miwok Indians	SIT: CVPIA Science Integration Team
SJCDWQC: San Joaquin County and Delta Water Quality Coalition	SLDMWA: San Luis & Delta-Mendota Water Authority
Social Responsibility: Physicians for Social Responsibility	Solano RCD: Solano Resource Conservation District
SolanoCo: County of Solano	SSI: Sierra Streams Institute
Stantec: Stantec	State Lands: California State Lands Commission
State Parks: California Department of Parks and Recreation/State Parks	Stockton: City of Stockton
Stockton Port: Port of Stockton	Sunzi: Sunzi Consulting LLC
SustainDelta: Coalition for a Sustainable Delta	SutterCo DSD: Sutter County Development Services Department
SVWQC: Sacramento Valley Water Quality Coalition	SWC: State Water Contractors
SWRCB: State Water Resources Control Board	Tehama-Colusa: Tehama-Colusa Canal Authority
Tetra: Tetra Tech	Three Valleys: Three Valleys Mutual Water District
TNC: The Nature Conservancy	Tracy: City of Tracy
Trout Unlimited: Trout Unlimited	Tufts: Tufts University
Turlock: City of Turlock	UC Berkeley: UC Berkeley
UC Davis: UC Davis	UC Irvine: UC Irvine
UC Merced: UC Merced	UC San Diego: UC San Diego
UC Santa Cruz: UC Santa Cruz	UCANR Coop: UC Agriculture and Natural Resources Cooperative Extension
UCLA: UC Los Angeles	UCol Denver: University of Colorado, Denver
Union Concerned Sci: Union of Concerned Scientists	UPacific: University of the Pacific

USACE: US Army Corps of Engineers	USBR: US Bureau of Reclamation
USDA: US Department of Agriculture	USDOI: US Department of the Interior
USEPA: US Environmental Protection Agency	USF: University of San Francisco
USFWS: US Fish and Wildlife Service	USGS: US Geological Survey
UWyom: University of Wyoming	Vacaville: City of Vacaville
Valley Water: Santa Clara Valley Water District	Vestal: Vestal Corporation
Virga: Virga Labs	Watercourse: Watercourse Engineering, Inc.
West Sac: City of West Sacramento	Westervelt: Westervelt Ecological Services
Westlands: Westlands Water District	WestSac Port: Port of West Sacramento
With Our Words: With Our Words	Wonderful Orchards: Wonderful Orchards
WoodardCurran: Woodard & Curran	Woodland: City of Woodland
Woodland-Davis CWA: Woodland-Davis Clean Water Agency	WRMP: San Francisco Estuary Wetlands Regional Monitoring Program
WSJRWC: Westside San Joaquin River Watershed Coalition	YoloCo: County of Yolo

Tables

Table F-3. *Participation by Organization Type. The first column indicates the number of entities in each category that participate in either the whole network or the core network. The second column displays the mean number of venues in which each type of participant is involved.*

Participant Type	Number of Participants	Mean Number of Venues
Full Network		
Government (Federal)	9	5.1
Government (State)	20	3.0
Government (General Local)	34	1.2
Special Water District	25	1.5
Tribal Entity	9	1.0
NGO/Community Group	33	1.2
Research	30	1.8

Consultant	25	1.2
Consortium	8	1.1
Private (Other)	1	1.0
Core Network		
Government (Federal)	6	7.2
Government (State)	9	5.3
Government (General Local)	5	2.2
Special Water District	4	3.6
Tribal Entity	0	0
NGO/Community Group	4	2.5
Research	13	2.9
Consultant	4	2.3
Consortium	1	2.0
Private (Other)	0	0

Table F-4. *Participation by Venue. The first column displays the total number of participants in each venue, while the second column indicates the number of core participants involved in each venue.*

Venue	Number of Participants	
	Full	Core
COEQWAL: Collaboratory for Equity in Water Allocations	52	18
Delta RMP: Delta Regional Monitoring Program	49	9
IAMIT: Interagency Adaptive Management Integration Team	29	23
WRMP: San Francisco Estuary Wetlands Regional Monitoring Program	28	14
SIT: CVPIA Science Integration Team	26	22
CSAMP/CAMT: Collaborative Science and Adaptive Management Program/ Collaborative	24	16

Adaptive Management Team **on pause as of Fall 2025*		
CWEMF: California Water and Environmental Modeling Forum	23	12
DIISC: Delta Inter-agency Invasive Species Coordination Team	21	15
CoP: Bay-Delta Social Science Community of Practice	20	13
DPIIC: Delta Plan Interagency Implementation Committee	18	14
CAWQMC: California Water Quality Monitoring Council	16	2
ITAG: Interagency Telemetry Advisory Group	11	11
IEP: Interagency Ecological Program	10	10

References

Emerson, K., Nabatchi, T., & Balogh, S. (2012). An integrative framework for collaborative governance. Journal of public administration research and theory, 22(1), 1-29. Acknowledgements

Acknowledgements

Many thanks to Dr. Mateo Robbins for guidance and perspective on how the previous Appendix was made and how to update the new document, as well as to Dr. Tara Pozzi for much-appreciated advice on coding.

Hyperlinks

[1] https://sciencetracker.deltacouncil.ca.gov/

Resource G: Processes for independent scientific review and scientific advice

Background and objective

The Delta Science Program (DSP) provides independent scientific review (review) and scientific advice (advice) for processes, programs, plans, and products as part of its mission "to provide the best possible unbiased scientific information to inform water and environmental decision-making in the Delta." (Water Code Section 85280(b)(4)). Scientific **peer review and advice services enhance the scientific rigor, transparency, and credibility** of science underpinning management and policy decisions in the Bay-Delta system.

The processes outlined in this document describe how the DSP facilitates scientific review and advisory services in the Bay-Delta, providing context for those who may request or participate in DSP-facilitated reviews. Reviews and advice follow the same process, but there are distinct differences between the two services. The key difference is that advice evaluates processes, programs, plans, or products that are in development, while reviews evaluate processes, programs, plans, or products that are complete. Review panels are the most common type of panel organized by the Delta Science Program. For simplicity, the rest of the document will collectively refer to reviews/advice as 'reviews' and to reviewers/advisors as 'reviewers'.

Terminology

The DSP peer review and advice process uses the following terms.

- **Requesting party:** Agency or entity requesting the review to be conducted through the Delta Science Program on behalf of the agency or entity. The requesting party is responsible for funding the project and for ensuring the review materials are ADA accessible before the start of the review process.
- **Independent scientific reviewers (reviewers):** Subject matter experts tasked with completing the review as individuals or as part of a panel.
- **Delta lead scientist**: "The lead scientist shall oversee the implementation of the Delta Science Program" (CA Water Code § 85280 (2024) (3)). In the context of Independent Scientific Review and Scientific Advice, the Delta lead scientist is responsible for considering recommendations from the DSP and planning team, and for providing independent final decisions on the Charge and

reviewer participation. They officially receive review requests and transmit final products.

- **DSP project manager:** The DSP staff member who leads the facilitation of the review effort. They coordinate all meetings throughout the process, execute contracts with the reviewers, and act as the intermediary between the requesting party and the reviewers.
- **Planning Team:** Generally consists of members of the requesting party, authors of the document(s) up for review, and/or interested agency/entity representatives. The Planning Team members may weigh in at various stages of the review process, depending on the level of review sought.
- **Charge:** At a minimum, this includes background information, the questions to guide the reviewers, the review materials, tasks, and a timeline. Sometimes referred to as a charter.
- **Product**: The tangible deliverable required of the reviewers, as outlined in the Charge, for example, memos or reports.

General timeline

The duration of review efforts varies with the complexity and scope of the Charge, but generally requires six to twelve months to complete. The process includes the following steps:

- Request for review
- Decision to provide review
- Development of scope for review
- Selection of subject matter experts
- Experts conduct a review
- Release of final products

Details of these steps are explained in depth throughout this appendix.

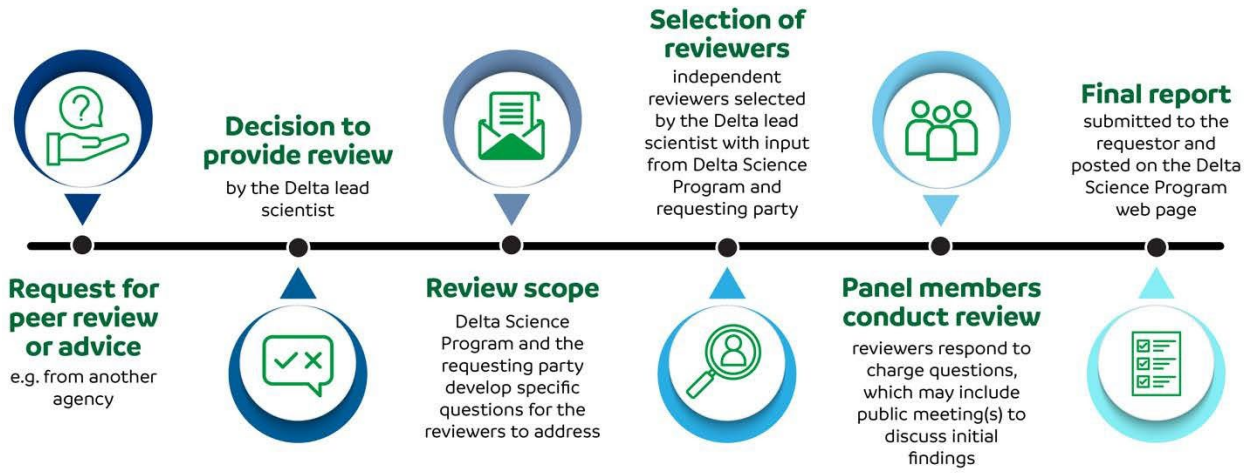


Figure G-1. Peer Review Timeline.

Request and decision to provide review

Independent scientific review or scientific advice may be requested by one or more entities, submitted via a request letter, and will focus on one or more written documents. The **requesting party** is financially responsible for the review services and, in most cases, requires a receivable agreement[1] to be established with the Delta Stewardship Council.

The DSP's decision to provide review depends on the DSP's capacity and how the request's goals and objectives align with those of the Delta Stewardship Council's mission. Moreover, the DSP will only agree to provide a review/advisory panel if:

- there is sufficient funding available for the services **(services paid for by the requesting party)**
- there is sufficient time available to complete the review work and deliver the written product(s)
- Review materials provided by the requesting party to ensure they are complete and ADA-compliant before starting the review

The final decision to provide a review rests with the Delta Stewardship Council, pursuant to consultation with the Delta lead scientist.

Planning meetings

Planning meetings are critical to ensure the review process stays on track and will occur at key decision points. Participants in the planning meetings include the Delta lead scientist, DSP project manager, DSP staff, and members of the Planning Team.

Members of the Planning Team **may**:

- Communicate their expectations for the review
- Provide input on the Charge to the Reviewers
- Inform the review schedule, public meeting format, and agenda, when applicable
- Identify desired expertise
- Recommend subject-matter experts to serve as reviewers when appropriate
- Provide pertinent background documents or other materials to review – **only through the DSP**

Members of the Planning Team **may not**:

- Speak directly to the reviewers (DSP staff will facilitate all communication between reviewers and the Planning Team)

Considering the input from the requesting party and planning team, the Delta lead scientist makes final decisions about the Charge and selection of subject matter experts.

Reviewers

Potential reviewers are identified through recommendations from DSP staff, the Delta lead scientist, and members of the Planning Team (when appropriate). The DSP is committed to improving and integrating diversity and inclusion in independent science reviews, and when selecting reviewers, aims to consider a variety of perspectives, including:

- An individual's standing in the scientific community
- Expertise in disciplinary areas

- Technical skills relevant to the documents and issues subject to review
- Absence of a demonstrated conflict of interest (see: Resource E: *Conflict of Interest Process for Reviewers, Advisors, and Applicants*)

Reviewers are expected to possess the necessary knowledge to complete the review and may hold some familiarity with the geographic region, physical processes, policy issues, ecosystems, and species-specific aspects for which scientific review is sought. The Delta lead scientist has the final recommendation for the selection of reviewers.

Reviewers can be contracted through the organization they're affiliated with, including public agencies, academic institutions, corporations, or sole proprietorships. Reviewers should verify the California state requirements necessary to conduct business with the state[1].

Reviewers may work independently or collectively as a panel to provide a scientific review. The panel type is discussed with the planning team and determined by the Delta lead scientist. Panels generally consist of no fewer than three members and include a "Panel Chair," who represents the panel, coordinates meetings, and organizes the panel's work, and a "Lead Author," who leads the report writing. These roles typically require extra hours and additional compensation. For individual letter reviews, Reviewers contribute single-authored reports but are encouraged to discuss materials or findings with one another.

Charge to the reviewers

The Charge specifies the purpose and background of the review and presents Charge questions. Charge questions guide how reviewers evaluate the documents at the focus of the review and help ensure the requesting party receives useful recommendations from the review.

Charge questions should be crafted to draw on applicable technical guidance, but not to solicit policy recommendations or prescriptions (e.g., specific numerical changes to a regulatory threshold). However, it is recognized that responses and other information in a review final report may be used in future decision-making by resource managers and policymakers because all final reports are publicly available online.

The scope of the Charge to the Reviewers will include:

- Background information (including the legal, regulatory, and management background necessary to set the full policy context)
- Charge questions for the reviewers
- A description of the role of the reviewers and rules for its deliberations (if a panel)
- The form and scope of the final product
- Additional required or recommended reading materials (i.e., supplemental materials)
- A schedule of deliverables

The Delta lead scientist has the final authority for the language in the Charge to the reviewers.

Peer review public input process

Background

The review and advice process shall be open and transparent to the extent possible and may include public-derived input, when necessary. Though maintaining the independence of a review panel is critical, public input may be essential to a review process. Government agencies exist to serve the public, whose collaborative participation in regulatory and programmatic efforts strengthens decision-making, improves outcomes, and builds trust among groups with a diverse set of perspectives.

Decision to include public input

If a party requesting peer review also requests public input as part of the process, the Delta lead scientist determines whether to include public input as part of the review/advice effort based on the following factors:

1. The scope of the review is relevant to multiple entities (e.g., Water Temperature Model Platform Review[2])
2. The scale of the review is significant and the project impacts multiple entities (e.g., Biological Goals Advisory Panel[3])

3. If there is sufficient time to receive public input

Types of public input

Once the decision has been made to include public input in the review, two options (hybrid public meeting or written public input) for the format of public input are available. The means of public input will depend on whether there is adequate time, DSP capacity, and/or funding.

1. **Hybrid public meeting (default)** – a hybrid public meeting occurs roughly halfway through the review process; panel members present their initial findings and receive presentations from the requesting party and/or other interested groups and hear public comment. Information from the meeting may inform the panel's final report at the panel's discretion.

2. **Written public input** – in lieu of a public meeting, written public input (not to exceed two written pages) is submitted roughly halfway through the review process. Written public input is solicited via an email announcement to the Council's email list subscribers and posted on the review webpage. Submitted input is received via email (as PDF), US mail, or in person. Input is screened for relevance to the Charge by DSP staff and the Delta lead scientist, and (if relevant) provided to the panel as Supplemental Review Material and posted on the DSP peer review web page. Written public input may inform the panel's final report at the panel's discretion.

Hyperlinks

[1] https://www.dgs.ca.gov/PD/Resources/Page-Content/Procurement-Division-Resources-List-Folder/How-to-do-business-with-the-state-of-California

[2] https://deltacouncil.ca.gov/delta-science-program/water-temperature-model-development-independent-advisory-panel

[3] https://deltacouncil.ca.gov/delta-science-program/biological-goals-advisory-panel

Resource H: Guidance for science workshops

This resource describes how the Delta Stewardship Council's Delta Science Program (DSP) typically organizes science workshops and suggests steps for interested parties who want to conduct a workshop or request that DSP conduct one. This resource describes workshops that are not subject to the Bagley-Keene Open Meeting Act requirements and that are not part of an independent scientific review (see Resource G: *Processes for independent scientific review and scientific advice*).

Background

As part of its mission to provide the best available scientific information to guide management and inform decision-making in the Bay-Delta system, the DSP promotes, supports, and coordinates science workshops to communicate the state of scientific knowledge on topics of importance to decision-makers. Workshops focus on an important scientific topic with significant management or policy implications, drawing on published papers, reports, and other relevant information, along with professional judgment and experience, within a short period of time. Below is a description of how DSP science workshops are conducted.

Decision to hold a workshop

A science workshop may be requested by the DSP, Delta Independent Science Board (Delta ISB), and/or an agency or other interested party. Workshops take many forms and prioritize scientific information related to an important topic with management or policy implications. Workshops are an opportunity to bring together diverse perspectives on a scientific topic. Workshop attendees can include agency personnel, policymakers, researchers, community-based organizations (CBOs), and interested members of the public. Those requesting a workshop should prepare a proposal that defines the high-level goals, specific objectives, and audience for the workshop. The proposal should also demonstrate how the workshop advances the Delta Stewardship Council's statutory mission.

The DSP's decision to conduct a workshop will depend on the capacity of the DSP and the relevance of the workshop to the goals and objectives of the Delta Stewardship Council. Further, the need for a workshop may influence the type or format of a workshop, such as:

- public input on a science initiative or project (e.g., Delta Science Plan Update)

- regular forum for discussion and networking (e.g., Adaptive Management Forum)
- requested workshop (e.g., Harmful Algal Blooms (HABs) Monitoring Strategy) emerging scientific topics (e.g., Microplastics Pollution)

Moreover, the DSP will only agree to conduct a workshop if sufficient funding and time are available to complete and deliver a report, if applicable, and if there is enough scientific information or sufficient scientific need to justify it. The workshop must also be consistent with the Delta Stewardship Council's mission. The ultimate decision to conduct a workshop rests with the Delta Stewardship Council in consultation with the Delta lead scientist.

Workshop planning team

A Workshop Planning Team (Team) typically forms at least six months in advance of the workshop date and meets regularly to plan the agenda and logistics. The Team may continue after the workshop to create summary documents or other products. The Team represents the workshop's audience to the extent possible and can include agency staff, CBOs, environmental justice experts, and social scientists. Opportunities to build and strengthen respectful relationships between tribes and the Delta Stewardship Council are explored within the scope of the subject matter. Participants in a Team communicate their expectations for the pending workshop, provide input on topics to be covered, identify tasks to be completed in advance of the workshop, consider the workshop agenda and speakers, and provide pertinent background documents or other instructional scientific materials for the workshop through the DSP.

The DSP holds workshops in a hybrid setting when possible. Remote participation enables easier public access, increases participation, and provides a straightforward pathway to record sessions for future reference. In-person workshops often allow for more informal networking and small-group discussions, but they require participants to travel. Fully online workshops can be challenging for individuals without reliable internet service or those who are not comfortable with online platforms.

Workshop format and agenda

The Team develops the agenda with consideration for the goals, objectives, and audience. A workshop can include a mix of oral presentations, panel discussions,

small breakout groups, poster sessions, and/or online collaboration tools. Invited presenters may be included for their experience within the Delta or for expertise outside the Delta that has applicable lessons. The workshop can also include a public solicitation for presentations or a call for public comments to allow broader participation. Presentations often provide necessary background and regulatory context, recent and ongoing scientific research, synthetic efforts by local experts, and scientifically based expert opinion.

Workshop materials

Providing materials to presenters or attendees in advance can enhance engagement by offering background information on the workshop topic or materials that will be discussed during the workshop. These might include a preliminary synthesis report prepared by or under the direction of DSP staff. Materials are often posted on the Delta Stewardship Council's website; however, they must comply with the Americans with Disabilities Act (ADA) accessibility standards.

Science workshop panel

When a panel is part of a workshop, it is recommended to have a broad range of institutions and expertise relevant to the workshop topic, which may include familiarity with the geographic region, physical processes, policy issues, social science, ecosystems, and species-specific aspects. The DSP aims to increase the interweaving of Traditional Knowledges into the Delta science collaborative science efforts, center community-based collaborative science, and continues to advance collaborative, community-based research in partnership with tribal and environmental justice communities. Panel selection reflects these priorities and diverse voices.

Public communication

A web page accessible through the Delta Stewardship Council's website provides background information on each Science Workshop, meeting agendas, the membership of convened panels, all background materials and presentations, and any resulting products or recordings. To the extent possible, all materials are posted on the website. Scheduling and other information the meeting and the availability of workshop report(s) are sent through the Delta Stewardship Council's listserv email announcements.

Example: Science workshops

Table H-1. *Examples of workshops hosted or coordinated by the DSP*

Title	Date	Organizers	Frequency	Example product	Format
Microplastic Pollution: Impact on the SF Bay Delta and Remediation Strategies[1]	May 2025	DSP and UC Davis	Standalone	Recording[2]	Hybrid
Delta Science Plan Workshop[3]	February 2025	DSP	As needed	Recordings: Day 1[4], Day 2[5]	Hybrid
Science for Communities	July 2024	Delta Stewardship Council Staff	Standalone	Recording[6]	Hybrid
Salinity Management Workshop	March 2024	DSP	Standalone	Information sheet[7], Recording[8]	Online
Adaptive Management Forum[9]	May 2023	DSP	Bi-annually	Summary report[10]	Hybrid
Delta HABS Monitoring Workshop	November 2022	Various	Standalone	Day 1 Recording[11] Day 2 Recording[12]	Hybrid
Science Synthesis workshops	Various	Various	As needed	Examples[13]	Various

Hyperlinks

[1] https://airtable.com/appEOgQ4D9g6QsZqP/pagPFvLQjDcaITtYz/form?mc_cid=b289fced42&mc_eid=UNIQID

[2] https://www.youtube.com/watch?v=vUWDuOXGuJM

[3] https://www.deltacouncil.ca.gov/pdf/science-program/agenda/2025-02-20-21-delta-science-plan-workshop-draft-agenda.pdf

[4] https://www.youtube.com/watch?v=z8elYmMC9m4&t=11923s

[5] https://www.youtube.com/watch?v=WntiNemmWEI

[6] https://www.youtube.com/watch?v=ZUp4NIUfxtw

[7] https://www.deltacouncil.ca.gov/pdf/science-program/2022-04-26-27-salinity-management-workshop-delta-salinity-primer.pdf

[8] https://www.youtube.com/watch?v=LHJtLe9z0HA

[9] https://www.deltacouncil.ca.gov/pdf/science-program/agenda/2023-04-18-adaptive-management-forum-agenda.pdf

[10] https://www.deltacouncil.ca.gov/pdf/science-program/reports/2025-03-18-2023-adaptive-management-forum-summary-report.pdf

[11] https://www.youtube.com/watch?v=ntwxK7S1JSE

[12] https://www.youtube.com/watch?v=KPllco_FlVg

[13] https://deltacouncil.ca.gov/delta-science-program/science-synthesis