

DELTA SCIENCE FUNDING AND GOVERNANCE WORKGROUP

DRAFT SUB-GROUP #4 REPORT August 30, 2019

EXECUTIVE SUMMARY

In response to their charge (see below), Sub-group #4 will:

1. Organize a 2.5 day workshop to identify a) key science needs to provide long-term management insights in the context of rapidly changing environments and b) recommendations for organizing the science enterprise to better address such complex and changing problems; and
2. Develop a report outlining recommendations on needed science infrastructure and governance based on the science needs assessment workshop.

SUB-GROUP #4 CHARGE

Develop an implementation plan for the following recommendations from the Delta Independent Science Board (Delta ISB) in their letter to the Delta Plan Interagency Implementation Committee (DPIIC).

1. Development of a broad and fundamental interagency and multidisciplinary science needs assessment via a workshop, followed by a draft assessment for policy refinement
2. Create a white paper summarizing different organizational approaches for science to better develop and inform further discussions

PROBLEM STATEMENT

In their letter to the DPIIC, the Delta ISB emphasized the rapidly changing environment and the need for more strategic and forward-looking management and science to respond to these changes. Current Delta interagency science efforts are not organized in a way that efficiently “support[s] the kinds of science-driven policies and solutions needed to address the Delta’s diverse, interacting, and rapidly changing management challenges which routinely span the mandates of multiple agencies.” There is a need for more forward-looking science to guide policy decisions, and for more integrated multi-agency organization to implement approaches to connecting science to management and policy in the Delta.

To address this need, the Delta ISB recommended a Science Needs Assessment and Workshop to guide a forward-looking science strategy to support management decisions in the Delta, and a report summarizing approaches to improve science governance to better prepare for rapid change. Moving forward will require scientific leadership and vision, identification of major scientific priorities, and organizational and funding structures to greatly expand interagency science integration. The Delta Science Plan identifies some existing mechanisms to foster interagency collaboration and communication to be expanded upon.

RECOMMENDED ACTIONS

Action 1. Conduct a 2.5-day science needs assessment workshop

Sub-group #4 proposes a 2.5-day Science Needs Assessment Workshop and additional efforts (e.g. pre-workshop briefing paper) that identify forward-looking science and provide recommendations to improve science governance (see Appendix A for a more detailed description of the workshop). The overall goals of the workshop are to:

- Identify key science needs to support long-term management in the context of rapidly changing environments; and
- Explore how to organize the science enterprise to better address such complex and changing problems.

The science needs identified at the workshop will be based around a set of management issues focused on climate change and other major changes identified through a management needs assessment in collaboration with Sub-group #2. Management issues and questions collected through this collaborative effort and those identified in the Delta Plan will be consolidated and refined and used as topic areas for breakout sessions at the workshop.

Participants in the first two days of the workshop will include those conducting, prioritizing, coordinating, and funding science in the Delta, representing agencies including those on the Delta Plan Interagency Implementation Committee and broader Delta stakeholders. A half-day session on the third day will involve higher-level management/directors to communicate the outcomes of the prior two days and receive feedback. The workshop will be held in early spring of 2020, allowing sufficient time for planning, scheduling, and logistics.

Prior to the workshop, members of Sub-group #4 and additional collaborators will prepare a briefing paper which will be disseminated to attendees to frame thoughts on discussion topics during the workshop (see Appendix B). The authors of the briefing paper will be:

- Jay Lund (Delta ISB)
- Amanda Bohl (DSC)
- Steve Brandt (Delta ISB)
- John Callaway (DSC-DSP)
- Mike Chotkowski (USGS)
- Louise Conrad (DSC-DSP)
- Lynda Smith (MWD)

Action 2. Develop recommendations on science infrastructure and governance

Following the workshop, a report outlining recommendations from the discussions will be developed and presented to the DPIIC. The document also will include discussions on organizational structures that promote more nimble and adaptive governance in response to rapid environmental change, which responds to the Delta ISB's recommendation #2. Moreover, the discussion on organizational structures may help facilitate another set of recommendations made by the Delta ISB to the Interagency Ecological Program (IEP) on the need to review and consider alternative organizational structures within IEP to better enhance collaboration and commitment with the IEP member agencies and stakeholders. In the future, coordination may be needed with IEP to assess whether this effort may assist with the implementation of the Delta ISB's recommendations on IEP's ability to produce science to support the management of the Delta.

APPENDIX A: SCIENCE ENTERPRISE WORKSHOP 2.0

A STRATEGIC SCIENCE NEEDS ASSESSMENT WORKSHOP TO MEET EMERGING CHALLENGES

Purpose

Strengthen the Delta Science Enterprise to support **strategic** and forward-looking management and stakeholder needs in the face of a rapidly changing environment.

Workshop Objectives

- Identify key science that needs to happen to provide answers to long-term management questions
- Discuss how to organize science and the science enterprise for complex and changing problems

Advance Briefing Paper

An advance briefing paper will be developed and distributed to all participants before the workshop. This briefing paper will provide a background on the science foundations for managing the Delta's changing challenges and will discuss recommendations from previous workshops and reports, the 'grand' science and management questions facing the Delta, the scientific foundations for adaptive management, the science organization, governance and funding needed to support science needs and ideas for engaging policy and decision-makers.

Background and Rationale

Fundamental environmental conditions in the Delta are changing rapidly, and we face a future that will likely be very different from the present. Climate change, a growing population, new invasive species, increasing demand for water diversion, shifts in land use, and declines in native species will fundamentally challenge our ability to sustain natural values in the Delta environment and deliver adequate water for California's farms and cities. Decisions made now will have consequences and perhaps constrain our options in the future in ways we cannot currently envision. We must, therefore, ensure that our science strategy elevates the theme of *change*, as a lot of change lies ahead.

The Science Action Agenda represents a major step forward and has identified key current management issues and short-term science needs. The underlying Delta Science Plan has set forth a host of mechanisms to foster interagency collaboration and communication. We propose to build on these efforts and develop a bold, forward-looking, longer-term science strategy that recognizes the ever rapidly changing Delta environment and looks farther into the future.

The stakes are high. Delta management requires the use of best available science. The cornerstone of Delta management is *adaptive management*, which works on the premise that one can learn by studying the effects of management policies and then changing those policies if new information indicates that other policies will better achieve desired outcomes. It depends on the ability to forecast outcomes. But management policies do not affect the environment in a vacuum. Underlying conditions in the Delta are, and have been, rapidly changing in the face of pressure from multiple drivers, including climate change. Clearly, management informed by careful forecasts of future

environmental conditions has a better chance of success. We must ask ourselves: is our science on the right track to predict future conditions sufficiently well that current and future management can succeed in a changed and rapidly-changing Delta? If we are concerned that our science isn't doing all it can, where can we improve? What are the emerging issues?

Focus on Climate Change

Climate change is perhaps the biggest single driver of environmental conditions in the future Delta. Climate has far reaching impact on all major Delta management issues/goals. It was singled out in both the Delta Plan and the latest State of the Bay-Delta Science as a fundamental 'stressor' that affects most of the other major drivers in the ecosystem. Climate-related changes will increase temperatures, lengthen summers, increase sea levels and hydrologic extremes, shift seasonal stream flows and change habitats that will open the door for new nonnative species and close it for some natives. As stated in the State of the Bay-Delta Science "The Delta's climate is characterized by high variability, and climate change is expected to accentuate this variability, resulting in both more extreme flood risks and greater drought risks. Thus, the Delta of the future will be very different than the Delta we know today" (Dettinger et al. 2016).

Next steps

Moving forward will require scientific leadership and vision, identification of major scientific priorities, and organizational and funding structures to greatly expand interagency science integration. This workshop will be the first step in developing a comprehensive scientific needs assessment based on fundamental system-wide scientific and management challenges facing the Delta relative to short-term (seasonal to interannual) and long-term (decadal or longer) changes in climate.

The primary audience for this workshop are those conducting, prioritizing, coordinating and funding science in the Delta as represented by DPIIC. Broader Delta stakeholders are also an intended audience so that they can begin to assess their strategic needs and expectations. Once scientific needs and components are identified, we can examine scientific structures, organizations and collaborations mechanisms, some outlined in the Delta Science Plan, Science Action Agenda and other documents, and funding initiatives to see if they are capable to address these priorities and recommendations.

The Science Needs Assessment Workshop – 2-days

Logistics and Timing

This will be a two-day workshop modelled and tailored to the specific management needs, scientific knowledge, conditions, and stakeholders in the Delta. An additional half day will be scheduled with policy managers and key agency leads to discuss workshop recommendations and next steps. The workshop will be held in winter of 2020, probably in March with a targeted participation of about 80 scientists from the Delta as well as other systems, Delta managers and Delta stakeholders.

Goals

The overarching purpose of the workshop is to develop a science strategy that addresses the effects of environmental change, especially climate change, on Delta's co-equal goals as driven by management and stakeholder needs. The workshop will focus on a strategic science needs

assessment directed toward identifying and prioritizing major research needs and future plans toward understanding changing climatic impacts on key physical, chemical, and biological processes identified in the Delta Plan in the context of potential changes in other major drivers. What are the fundamental scientific questions and how to we enhance our scientific enterprise to be able to address these questions?

Scope of the Scientific Questions

The workshop will examine climate-related science needs at short term (seasonal to interannual) and longer-term (decadal and beyond) time scales. The focus is large ecosystem level spatial scale. For example, we would not address specific restoration projects but the basic elements/goals/limitations of Delta restoration which, of course, would have trickle down applications to individual projects.

Specific Workshop Objectives

The workshop will focus on Key Scientific Theme areas from the Delta Plan and the management questions related to each of these themes:

- **Water Supply** Reliability, including water storage capacity, infrastructure capacity and needs
- **Nonnative species** including new introductions, spread and ecosystem impacts
- **Water quality** including nutrients, contaminants, human health
- **Delta flows** e.g. inundation, runoff timing, including extreme events such as drought and flooding
- **Restoration**
- **Fish and wildlife habitat** and productivity in including water temperatures, growing seasons, thermal tolerances, plant communities, – Abundance by Species, Size, Condition, Distribution, Habitat, and Food Web Structure and Function
- **Ecosystem sustainability**
- **Delta as Place**

The workshop will bring Bay-Delta scientists, managers and stakeholders together to:

- 1) Examine the current state of knowledge of the physical, chemical, and biological impact of climate change on the Bay-Delta. Such a knowledge base includes current scientific understanding, products, services, expertise, monitoring and observing systems, datasets, and forecast models.
- 2) Explore the magnitude of environmental changes that may occur in the future, based on present knowledge. What is expected, and what is possible? What indicators of change should we be studying? Are there potential emergent issues we should be looking for in the Bay-Delta (e.g. ecological regime shifts) that are informed by climate science and the experience of environmental change in other estuaries?
- 3) Develop a dialogue with Delta stakeholders to identify their key needs related to the impact of climate change on Delta resources.
- 4) Document key challenges that climate change impacts pose in continuing effective management, restoration and protection of the integrity of the Delta Ecosystem and related resources of particular concern to stakeholders.

- 5) Identify and apply presently available scientific expertise, products, services, monitoring and observing systems and forecast models that best support needs of stakeholders in confronting impacts of climate change in protecting, managing, or restoring Delta resources.
- 6) Identify new scientific research efforts and resulting products that will enhance stakeholder capabilities to better anticipate impacts of climate change on Delta resources and develop more effective, pre-emptive strategies to meet new challenges in managing, protecting, or restoring such resources.
- 7) Compile and disseminate a report summarizing workshop proceedings and recommendations.

Workshop Agenda – 2 days

Plenary Sessions

Plenary Session 1: *State of Our Scientific Knowledge*: Individual Speakers and Panels: The current state of scientific knowledge of present and expected future impact of climate change in the context of other long-term underlying drivers (such as population growth and changes in land use) that may affect the Bay-Delta. Informed speculation about potential emergent issues that we should consider studying more closely.

Panel sessions organized around the bulleted key scientific theme areas identified above

Plenary Session 2: *The Changing Future*: Individual Speakers and Panels: What can we forecast about climate change impacts in the Delta at seasonal, interannual and decadal scales? What is the level of uncertainty? What is really missing?

Panel sessions organized around the bulleted key scientific theme areas identified above

Plenary Session 3: *Management and Stakeholder needs*: Individual Speakers and Panels: Focus is on stakeholder needs and issues and concerns in confronting anticipated impacts of climate change on the Delta ecosystem and meeting new challenges in managing, protecting or restoring resources.

Panel sessions organized around specific stakeholder and manager groups including:

- Management of invasive species (e.g. invasive ‘weeds’)
- Recreation
- Land Use Zone Managers
- Commercial and Municipal Water Users
- Regional, State, Tribal and Local Policymakers and Managers

Plenary Session 4: *Climate Change: From Science to Solutions*: Individuals and Panels Discussion: practical approaches to improving our ability to forecast the future, explore potential emergent effects, and frame rigorous, reliable scientific products that are useful to managers and stakeholders.

Breakout Sessions:

Breakout Sessions that addressed science and stakeholder issues divided among the Key Scientific Theme areas defined above.

First Breakout – What Do We Need and What is Missing?

Information and Research Needs – based on science themes identified above

- 1) What do you see as major strategic research products (such as a forecast tools, technology, methods, models)? or information gaps in each of the Key Scientific Themes?
- 2) At what scale (geographic and spatial) is needed to address this need?
- 3) What do you see as immediate first steps in this theme area (within the next 5 years) towards achieving the strategic goals identified?
- 4) What do you see as longer-term needs (within the next 5-7 years) for Delta climate change research?
- 5) What scientific products, services, expertise is needed?

Consider:

- 1) Forecasts, Models, Prediction, Outlooks, Scenarios, Predictive / Decision-Making Tools, Uncertainty, Risk and Risk Assessment
- 2) Research to increase understanding and/or to expand knowledge base

Second Breakout – What information will stakeholders need?

- 1) Who are your stakeholders and how do you engage them in this issue?
- 2) What specific forecasts would be of value?
- 3) What is the best way for to communicate new information, tools and technologies related to this issue?
- 4) How do we maintain communications, collaboration, scientist-stakeholder engagement

Third Breakout – What is Needed to Get Us There?

- 1) What are the essential ingredients of a Science Governance/Funding Structure to achieve these goals?
- 2) What collaborations, integration and coordination are needed to achieve useful development and application of products and services?
- 3) Who should take the lead?
- 4) Are there implications for data, datasets, databases, monitoring and observing systems
- 5) Why is it of value to society?

Policy/management discussion of Recommendations – Half day

Policy managers and key agency leads will meet to discuss the workshop recommendation and next steps that can be taken to benefit the Delta.

Workshops Products and Follow-up

- Preparation of White Paper with specific recommendations
- Presentation to DPIIC with specific recommendations
- Communication products for wide distribution
- Consideration of recommendations in development of Next Science Action Agenda
- Development of implementation/funding/science governance structure necessary to achieve recommendations

Pre-Workshop Activities

- Gathering of essential background material and reading for participants including
 - Delta Science Plan
 - Science Action Agenda
 - Science Enterprise Report
 - IEP Science Strategy
 - Delta ISB review Delta Monitoring/adaptive management
 - Key scientific literature
 - 2016 Status of Bay Delta Science
- Invited speakers on dealing with Rapid Environmental Change and Horizon Scanning (being done by Delta ISB)
- Production of background briefing paper to introduce the topic, flush out key questions/gaps based on an analyses of previous reports/workshops and explore how the issue is being addressed in other major aquatic ecosystems.



APPENDIX B: DRAFT BRIEFING PAPER OUTLINE

Below is a draft outline of the pre-workshop briefing paper

1. Executive Summary (3 pages)
2. Introduction (2-3 pages)
 - Context of change and complexity
 - Goals of report
 - Structure of report
3. Approaches to Organizing a Science Needs Assessment (2 pages)
 - “Grand Challenges”
 - Management questions (from Sub-group 2)
 - Science questions
 - Immediate and long-term management questions
 - Scientific foundations for adaptive management
 - Continue what we have done before
 - Hybrids
 - Other
4. Today’s Dispersed Science (table) (2 pages)
5. Major Science Problems (2 pages)
 - Separations of expertise from problem responsibilities
 - Unreliable and fragmented funding
 - Dispersion and dissipation of efforts
 - Transparency
 - Synthesis
 - Lack of integrated foresight
 - Communications
 - Availability of information, data, documentation, journals, etc.
 - Others?
6. An Initial Draft Assessment of Science Needs (5 pages)
 - Foundations for Adaptive Management
 - Some Grand Challenges
7. Improving science organization and governance to support science needs (5 pages)
 - Some ways to organize science for complex and changing problems
 - Thoughts on organizing Delta science
8. Science funding to support science needs (2 pages)
 - How much?
 - Reliability
 - Effective administration of funds
9. Workshop objectives (2 pages)
 - Improve and expand science needs assessment for 5-50 year timeframe
 - Better focus science needs assessment on immediate and strategic decision needs
 - Develop ideas for engaging policy and decision makers
 - Others?
10. Conclusions and Next Steps (1-2 pages)

- Draft needs assessment based on findings from workshop
- Draft a white paper summarizing different organizational approaches for preparing science for major changes (recommendation 2)

References

Sub-group charge:

Issue: Our current science efforts are falling behind and are unable to prepare policy-makers for rapidly changing conditions in the 5-50-year time frame.

Findings:

- The Delta is changing fast due to changing climate (higher temperatures, seasonal shifts, more variable hydrology, higher sea levels)
- Rapid changes also are occurring in the composition of the Delta's ecosystem and water supply infrastructure
- Voluntary agreements also will need integrated science support that we are not currently prepared for

Recommendations:

- Development of a broad and fundamental interagency and multidisciplinary science needs assessment via a 2-day workshop, followed by a draft assessment for policy refinement
- Creation of a white paper summarizing different organizational approaches for preparing science for major changes would inform further discussions

The nature of long-range problems, science, and so-called "horizon scanning":

