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Estuary & Watershed Science:  
Science & Policy for the Delta



# Mutual Benefits: Linking Science and Policy in the Delta

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## Introduction

Scientists and decision-makers in the San Francisco Bay-Delta are not unique. Ecosystem management programs worldwide are exploring ways to better link science and policy as a means to enhance and restore the services that ecosystems provide to society. Improving the effectiveness of this link requires policy-relevant scientific research, effective communication of research findings, and an efficient means of altering policy when the desired outcomes are not achieved or when relevant scientific understanding changes.

## Enhancing Policy-relevant Scientific Research

Fostering policy-relevant scientific research requires dynamic leaders in both science and policy arenas and interactions that build trust among them. To be effective, the science needs to address relevant questions, meet standards of scientific rigor, and be unbiased politically (Clark et al. 2002 in Van Cleve et al. 2004). This requires scientists who are independent and informed about the issues that managers and policy-makers face and who recognize that increased scientific understanding can result from research inspired by policy questions. Yet research shouldn't be driven only by current policy questions. Long-term and anticipatory research is essential to develop the scientific knowledge base that will be needed for future decisions. These goals are facilitated by respectful interaction between both researchers and the policymakers whose decisions will be informed by the information gathered.

An effective structure for policy-relevant science acknowledges that disagreements among scientists are inevitable (e.g., differing interpretations of data or competing restoration proposals) and provides mechanisms for resolving these disagreements. Means of resolution include establishing a scientific assessment process (e.g., workshops aimed at achieving a consensus-based scientific understanding from exist-

ing studies); engaging a diverse community of scientists to develop conceptual and numerical models to explore the consequences of differing management alternatives (Van Cleve et al. 2004); and designing a series of experiments or a monitoring program to resolve disagreements.

Science will not provide clear policy solutions, but it can be useful in establishing the boundary conditions within which a policy decision can be reached (Meyer et al. 2010) and in articulating the likely consequences of policy alternatives. One compendium of lessons learned from several ecosystem management programs recommended scientific involvement early in program development (Van Cleve et al. 2004). They observed that when science was involved after program structure was fixed, the alternatives that could be evaluated were limited (e.g., only engineering solutions were considered). As a consequence, stakeholders were more likely to question whether all technically viable alternatives had been examined.

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### **Communicating Science Effectively**

Scientists all too often want to present the facts and then step back from the process. However, both policymakers and the public to whom they are responsible require clear and compelling images and statements that convey scientific findings and their relevance to policy decisions. Simply reporting data without providing the policy context is not a productive approach (Groffman et al. 2010). Effective communication among scientists, policymakers and the public requires dialogue and an exchange of perspectives with an attention to user-friendliness (Groffman et al. 2010). Dennison et al. (2007) emphasize development of “a common knowledge base by combining syntheses of key scientific results with information-rich [as opposed to information-dense] visual elements.” Well-designed conceptual diagrams can provide visual descriptions of current scientific understanding that transcend scientific jargon (Dennison et al. 2007). Report cards based on comprehensible and scientifically valid indicators are a proven tool for communicating ecosystem condition and evaluating the progress that results from management actions (Pantus and Dennison 2005). Research programs that are policy-relevant will provide scientists with the time and support to develop those key syntheses, as well as effective communication tools.

### **Changing Course**

Ecosystems are complex and dynamic, and scientific understanding of ecosystem processes grows continually, while remaining incomplete. This means mechanisms for efficiently altering policy in the face of new findings are essential. Adaptive management has been embraced as the way to accomplish this, although few examples exist where adaptive management experiments have been entirely successful. The lack of success has been attributed to a lack of leadership, inadequate funding, and the failure by decision-makers to see the need for this approach (Walters 2007). Although it is not a panacea (Schreiber et al. 2004), adaptive management remains the most promising

approach to managing complex ecosystems in the face of incomplete knowledge and changing conditions.

Monitoring is a critical but often insufficiently planned and inadequately funded step in the adaptive management process (Schreiber et al. 2004). Monitoring programs support adaptive management if “information is collected on the parameters identified in the development of the initial models of the system and in relation to the specific goals identified in the planning phase of a project” (Schreiber et al. 2004). The restoration program in the Florida Everglades has used this approach (Gentile et al. 2001). Two types of conceptual models were developed, and outcomes of different management actions were explored using these models. The first modeled the societal activities and drivers that created the existing environmental stressors. The second modeled ecosystems in 20 landscape units using the stressors as drivers, and the ecological endpoints identified in these models provided the basis for performance measures around which monitoring programs were designed (Gentile et al. 2001). Beginning with a list of 1,000 possible indicators, the number to be tracked was reduced to 50, and—after distilling, integrating, and prioritizing—eventually fewer than 10 were reported to high-level decision-makers (Van Cleve et al. 2004).

Advantages of this approach include its provision for direct links among policy decisions, stressors, ecological outcomes, and monitoring programs that measure indicators for assessing performance. If the decision-making structure enables management actions to be modified based on these performance measures, effective adaptive management is possible.

### **Improving the Science–Policy Link in The Delta**

Having observed the science–policy interface in the Delta for over a decade, I have concluded that implementation of a limited and carefully chosen suite of performance measures is a crucial missing link in the adaptive management cycle. Although programs and restoration projects are proposed, performance measures to assess ecological outcomes of these programs and projects are often long, unranked lists of ecological indicators with many remaining “to be developed” and without attention to the monitoring program needed to measure them. For example, the Ecosystem Restoration Program’s (ERP) Draft Conservation Strategy from July 2011 (<https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=31232>) lists 156 performance measures for ecological outcomes, 36 of which are “to be determined;” targets for 129 are also “to be determined.” Many measures identified are vague, and monitoring priorities are not clear. This document offers no evidence that the winnowing process used in the Everglades example has occurred. ERP and other Delta programs are not unique in this respect: an evaluation of several ecosystem restoration projects found that “few programs have actually established performance measures “ (Van Cleve et al. 2004). Yet without performance measures based on clear conceptual models and an associated monitoring program, adaptive management cannot be successful.

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Many of the pieces needed to link science and policy exist in the Delta, providing cause for optimism. The recently released second draft of the Delta Science Plan ([http://deltacouncil.ca.gov/sites/default/files/documents/files/Delta%20Science%20Plan%20-%20Second%20Draft\\_082213\\_Final.pdf](http://deltacouncil.ca.gov/sites/default/files/documents/files/Delta%20Science%20Plan%20-%20Second%20Draft_082213_Final.pdf)) has many elements that incorporate the ideas discussed in earlier parts of this essay. In particular it proposes mechanisms to foster and support synthesis and to enhance communication between scientists and decision-makers. It could be effective if adequately funded and if embraced by both science and policy communities in the Delta. To reiterate, many of the pieces needed to link science and policy exist in the Delta; it remains to be seen whether the political will exists to ensure that these pieces can be assembled to create an effective science-policy landscape.

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