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# Collaborative governance and adaptive management: Lessons from California's CALFED Water Program

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## ARTICLE INFO

### Keywords:

Collaboration  
Adaptive management  
Governance  
Water policy  
California

## ABSTRACT

Both for its technological and institutional innovations and for its history of conflicts, California's water system has been one of the most observed in the world. This article and this Special Issue on the CALFED Bay-Delta Program continue in this tradition. CALFED is likely the most ambitious experiment in collaborative environmental policy and adaptive management the world has seen to date. This Issue moves beyond the celebratory tone of other analyses of collaborative, adaptive management and looks closer into how collaborative networks work to produce innovation, and more importantly to reflect also on their inherent contradictions, limitations and "dark sides". While collaborative governance enhances mutual understandings and can be a source of innovation, it appears ill-suited to resolve alone the distributive dilemmas at the core of many water – and other environmental – conflicts. A lacuna in existing research concerns the institutional design of effective boundaries and linkages between democratic politics, legitimate authority, and adaptive governance, i.e. the mix of institutions that can provide sufficient responsibility, accountability and democratic legitimacy, without choking off the self-organizing interaction, shared learning, and communication that is at the heart of collaboration. A painful realization in the Delta is that environmental conservation and further growth may be fundamentally at odds; efficient win-win solutions, institutional or technological, seem insufficient to satisfy the competing demands posed upon the system. Radical decisions and changes might be necessary, but they seem unlikely under current institutional arrangements and political conditions.

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## 1. Introduction

California's water system has for decades stood as not only one of the largest and most complex in the world, but also one of the most innovative. As such, it has also been one of the most *observed* water systems. This Special Issue continues the tradition of studying and learning from California's innovations, with a multi-disciplinary collection of articles and commentaries focused on the CALFED Bay-Delta Program, perhaps the most ambitious experiment in

collaborative policy and adaptive management the world has seen to date.

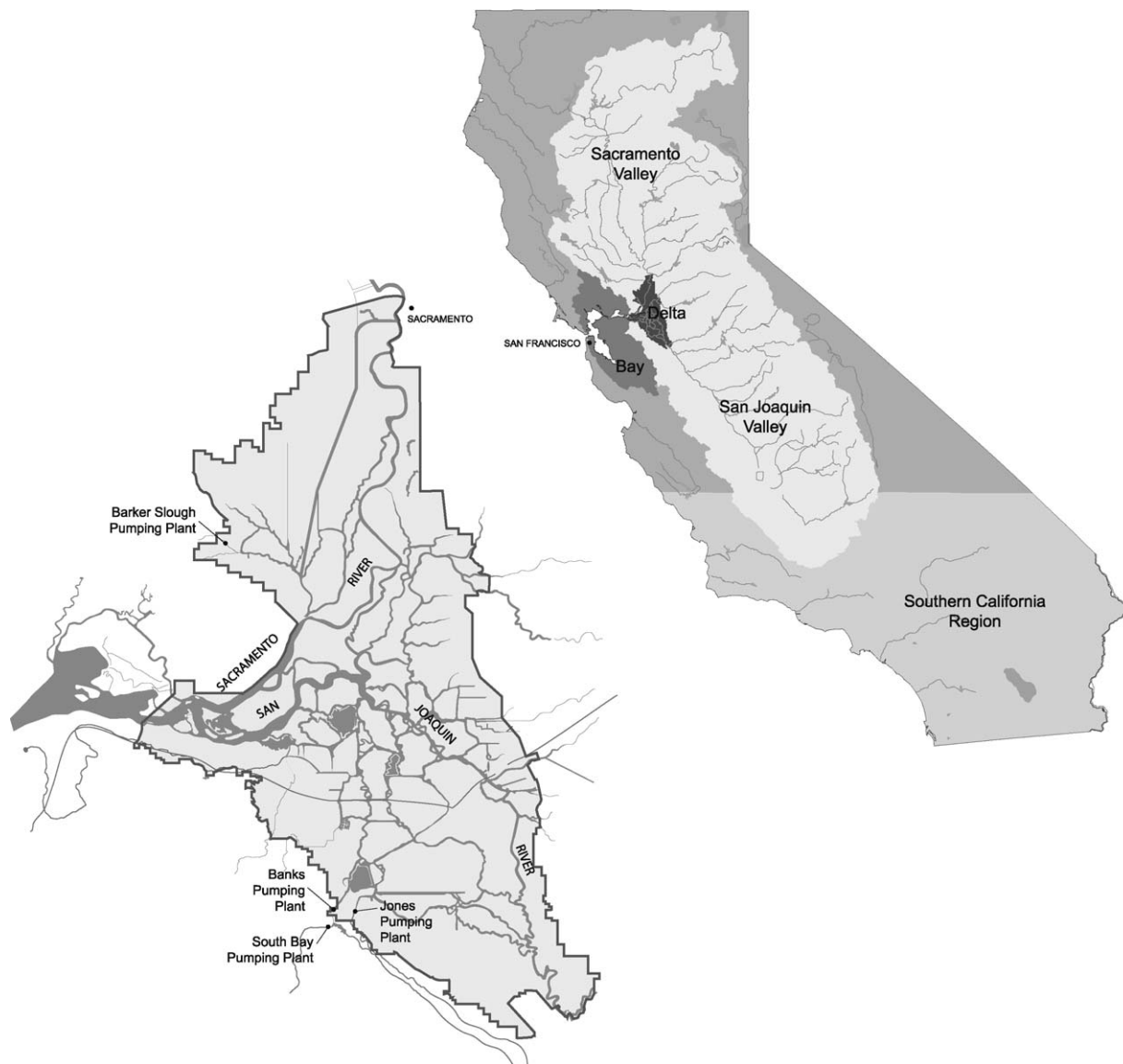
Water has long been a critical resource in California, one of the world's largest economies. The Bay-Delta (Fig. 1) is an estuary comprised of San Francisco Bay (hereafter "the Bay") and Sacramento–San Joaquin Delta (hereafter, "the Delta"). The Delta is both a fragile, valued ecosystem and the water 'hub' of California through which 22 million people, two thirds of the state's population, receive at least some of their drinking water. Its management also directly impacts the

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doi:10.1016/j.envsci.2009.07.002



**Fig. 1 – Regions of California, with detail of the Sacramento-San Joaquin Delta. Figure courtesy of California Department of Water Resources.**

condition of habitat in the Bay. The Delta has been the central battlefield in California's "water wars". Interventions to transform it have pitted north against south, locals and environmentalists against cities and farmers (Hundley, 2001).

In 1994 over 25 federal and state agencies and representatives of more than 30 major stakeholder groups and local agencies agreed to collaborate in an integrated program of restoration and management of the Bay-Delta. The CALFED program, as it came to be known, was celebrated as the end of California's water wars (Rieke, 1996). \$3 billion were spent on restoration, research, and water banking between 1994 and 2006. CALFED is probably "the world's most extensive – and expensive – water management program" (CALFED, 2000, p. 1). \$1 billion alone went to what is "the largest program of environmental restoration in American history" (Hundley, 2001). CALFED was praised as "a leading edge experiment" in collaborative planning (Innes et al., 2006, 2007), a new model of

environmental regulation (Freeman and Farber, 2005) and an exemplar of adaptive management (Hundley, 2001). Yet a general discontentment with the program's management, coupled with its failure to achieve in the short-term its stated goals, led to its eventual dissolution by 2007 (Fig. 2).

What happened in the Bay-Delta concerns the rest of the world. Collaborative, adaptive governance based on inter-agency integration and stakeholder participation is the new paradigm for managing environmental problems (Lemos and Agrawal, 2006; Folke et al., 2005). These ideas underpin major policy initiatives elsewhere in the world, such as the EU Water Framework Directive (Kallis and Butler, 2001). This Special Issue aims to shed light on the attributes of effective environmental governance, but also on its limitations and contradictions. Any attempt to understand a program of such immense scale and complexity might be likened to blind men and women groping at an elephant; a unified, complete picture

**Water quality.** Salinity intrusion from the Bay into the Delta has resulted from water operations and geomorphic change. Fluctuating salinity levels were probably part of natural Delta ecology, but historical levels and patterns are not well understood. Harmful disinfection byproducts result from treating drinking water containing naturally occurring Dissolved Organic Carbon and Bromine from sea water.

Pollution concerns include elevated concentrations of: organics and nitrates from local urban/industrial run-off and agricultural drainage; mercury from mine tailings, automobile exhaust and household items; pesticides from agricultural run-off; selenium from agricultural soil.

**Ecosystem health.** Declining populations of salmonids and pelagic fish. Reasons possibly include a combination of reduced Delta inflows, increased pumping (fish caught in the pumps), water quality, habitat change and reduced food availability due to invasive species, ocean conditions (for anadromous species), altered hydrologic patterns and physical conditions in the upper watersheds, and other anthropogenic impacts.

**Levee stability.** ‘Islands’ which have subsided below sea level (in some cases >15 feet) are protected by levees built atop fragile solids. Scientists calculate a 2 in 3 chance of a catastrophic levee failure in the Delta from winter storm run-off or an earthquake in the next 45 years (Mount and Twiss, 2005). Such failure could profoundly impact the viability of California’s water supply system.

**Water supply.** All of the above issues bear on the reliability of California’s water supply system. As originally conceived, CALFED attempted to address the above issues, as well as including in its solution space improvements to water storage, conveyance, and marketing. A recurring theme in Delta management is the engineering of the system through a “peripheral canal” or “isolated facility” that would transport water around the Delta directly to the existing pumps, instead of through channels in the Delta. Advocates claim increased supply reliability, better drinking water quality, and less impact on fish as operation of pumps will cease. Opponents question environmental benefits and fear increase of water exports from North to South, and reduction of water inflows in the Delta harming local uses and increasing salinity.

**Fig. 2 – Some key issues and conflicts in the Delta. Issues in the California Delta are myriad, interconnected, and complex. This brief description offers some contextual information for readers of this Special Issue but does not do justice to the complexity of problems and differing viewpoints on each of the above. See Healey et al. (2008) for a recent assessment of the scientific issues in the system, and other articles in this issue for entry points to ongoing Delta debates.**

is almost impossible to construct. This Issue brings together the scholarship of a multi-disciplinary, multi-perspective group of researchers and practitioners in the hopes that the whole of our individual observations will amount to more than the sum of its component parts. Our findings speak both to the international academic community concerned with environmental governance and to the California water policy community. We hope that our collective insights add something to the search for viable solutions to the water conflicts centered around the Bay-Delta, and can inform efforts to tackle other complex environmental management problems. This article opens the Special Issue with a literature review that synthesizes existing studies on CALFED with the invited contributions in this issue. Section 2 gives a brief history of the evolution of institutions in the Bay-Delta. Section 3 revisits the literature on collaboration and adaptive governance, much of it informed by past studies of CALFED. Section 4 recaps the key insights of the contributions in this issue concerning the procedural attributes of successful collaboration. Section 5 in turn identifies potential limitations, particularly in relation to questions of political economy, justice and the still prevalent notion that humans can ultimately control complex socio-ecosystems. We conclude in Section 6 reflecting on the aftermath of CALFED and its lessons for similar initiatives in different scales and locations.

## 2. The California Bay-Delta and CALFED

The Delta drains 60% of California’s runoff, all of the water flowing into the Central Valley with most of that from Sierra Nevada mountain range. It is the hub of California’s complex water distribution system, consisting of the Federal Central Valley Project (CVP) and California’s State Water Project (SWP). The projects consist of major reservoirs that store water that falls as precipitation mainly as snow in winter. This water is conveyed through a network of rivers and built infrastructure from the water-rich northern and eastern areas of the state to the population and agricultural demand centers in the south. Much of this water is pumped through the Delta.

The lineage of Delta conflicts can be traced back to the 19th century when levees were built on the peat soils to reclaim land for farming (Mount and Twiss, 2005) and gold miners and farmers fought over the sediment flowing through mining operations in the Sierra foothills. With the construction and expansion of CVP and SWP in 20th century, conflicts centered around water allocation, environmental protection and water quality leading to the founding of the State Water Resources Control Board (SWRCB) in 1967 (Norgaard et al., 2009; Hanemann and Dyckman, 2009; Hundley, 2001). A major political milestone was voters’ approval of a statewide ballot in 1982 against a Peripheral Canal, that would by-pass and

convey water around the Delta to the south (Hanemann and Dyckman, 2009; Gottlieb, 1988). The argument of the environmental groups and Delta communities and farmers that initiated the referendum was that the Canal would facilitate higher exports from north to south, impacting fisheries and ecosystems in the Bay-Delta, leaving less water for local uses and increasing saline intrusion from the Bay, arguments that resonated particularly with locals and Northern Californians (Hanemann and Dyckman, 2009 for a more nuanced analysis). In the years after the ballot, attention shifted from increasing water supply to improving water quality (Gottlieb, 1988). Diffuse sources of pollution from agriculture, automobiles and abandoned gold mines contaminated the Delta and Bay. In dry seasons, seawater intruded the Delta as pumps exported more freshwater. In 1986 the California Court of Appeals made an unprecedented ruling, the 'Racanello decision', which in effect ordered the SWRCB to broaden its mandate to protect all beneficial uses of water, not restricted as before to water rights. This in effect shifted some of the onus for water quality and environmental protection to senior water users and strengthened environmental protections (see Hanemann and Dyckman, 2009). As state authorities and the SWRCB were reluctant to impose such limits on agricultural and urban water users, Federal authority moved to fill the void. The EPA under the Clinton Administration ordered the State to reduce water exports from the Delta and bring salinity levels within the standards of the Clean Water Act. Delta smelt and winter run Chinook salmon were listed as endangered under the Endangered Species Act (ESA), perhaps the most powerful environmental law in the U.S. Then during the 1992 drought that threatened agricultural and urban supplies, Federal fish agencies ordered the projects' pumps halted to reduce the uptake of endangered fish (Connick and Innes, 2003). In the same year the Congress passed the Central Valley Project Improvement Act, dedicating substantial environmental flows and funds for restoration in watersheds above the Delta.

Around this time several alternative processes arose in attempts to head off the growing crisis. First, the San Francisco Estuary Project (SFEP) brought agricultural, urban, business, and development interests together to develop a plan for restoration and management of the Bay (Connick, 2003). Second, the SFEP spawned a "Three-way process" in which agricultural, urban, and environmental groups met informally in attempts to reach agreements on flows themselves (Connick, 2003; Innes et al., 2007). Third, four Federal agencies (Environmental Protection Agency, Fish and Wildlife Service, National Marine Fisheries Service, and US Bureau of Reclamation) pledged to cooperate on Bay-Delta actions. While none of these processes alone resulted in an overarching solution to the problems in the Bay-Delta, they did generate capacity building and institutional learning.

As environmental stresses in the Delta increased, attempts to forge solutions built towards a key turning point: in 1994, the Bay-Delta Accord established CALFED's collaborative process by bringing stakeholders together in a new forum. However, it did not describe how its goals would be accomplished, assign institutional responsibilities, or seek its own implementation and enforcement authority. State and federal agencies and selected stakeholders established a set of interim measures covering export limits, operational flex-

ibility to comply with the ESA, and measures to improve environmental conditions in the Bay-Delta. The mandate was to come up with an integrated program for the Bay-Delta. This eventually took the form of the Record of Decision (ROD), a requirement for the Environmental Impact Statement process of the program. CALFED got financial support from state and federal governments, in-kind support from agency staff dedicated to the effort, as well as three bonds passed under the initiatives of stakeholders, with a total of \$3 billion (Hundley, 2001).

In this first phase of CALFED between the Accord and ROD (Fig. 3), the process was led by a high-level Policy Group with heads of state agencies and high-level officials from federal agencies, supported by a Management Team of deputy directors charged to implement their decisions. Formal public input came from a Bay-Delta Advisory Committee (BDAC) made up from stakeholders from different interest groups (Innes et al., 2006). However, most of the work and initiative was taken up by ad hoc interagency, stakeholder and mixed groups under the umbrella of the Policy Group or BDAC that developed agreements and action plans for particular issues.

The Record of Decision was signed in 2000 by 24 State and Federal agencies and included – among eleven programmatic areas – action plans for levee system integrity, ecosystem restoration, drinking water quality, and water supply reliability, and an innovative Science Program (ROD, CALFED Bay-Delta Program, 2000). In effect, the ROD formalized an agreement by which environmental restoration and limited releases of environmental water would be exchanged for continued exports. The effects of this "soft" option were to be evaluated after seven years, while the possibility of a (smaller) Peripheral Canal would be studied (Hundley, 2001). The ROD was notable for its scope and ambition, and for its lack of specificity; it was more an "agreement about heuristics for continuing to work together" (Innes et al., 2007, p. 204). The Legislature decided to set up an independent California Bay Delta Authority (CBDA) to oversee the program, composed of Governor appointed regional representatives and selected agencies heads (LHC, 2005). Much of the rest of the CALFED program remained structured around working sub-committees, such as the Environmental Justice committee (Shilling et al., 2009) and programs and work-groups such as the Science Program and the Ecosystem Restoration program (Norgaard et al., 2009; Taylor and Short, 2009) or the EWA (Lejano and Ingram, 2009), that are discussed in this Special Issue.

Whether CALFED failed or succeeded in its mission is subject to debate, as we discuss below. An evaluation ordered by the Governor towards the end of the seven-year period concluded that the program had largely failed to achieve its goals, particularly those of reversing declining species populations and improving levee stability. The CBDA was disbanded, downsized, and passed to the Resources Agency, with only the Science Program surviving intact.

As this Issue goes to press, the mantle of comprehensive Bay-Delta institutional arrangement remains unclaimed. The Governor ordered a Delta Vision Blue Ribbon Task Force to produce a new vision for the Delta and a strategic plan, and more emphasis has been given to an existing agency, the Bay Conservation and Development Commission. Independent of

	<b>1980</b>	
	<b>1982</b>	Peripheral Canal defeated in State referendum
<b>Pre-Calfed</b>	<b>1986</b>	Racanelli decision
	<b>1987</b>	Beginning of 6-year drought
	<b>1990</b>	
	<b>1992</b>	Central Valley Improvement Act. Biological opinion – temporary halt to SWP/CVP pumps
<b>Phase 1</b>	<b>1994</b>	Bay Delta Accord signed
	<b>1995</b>	Policy Group; Bay Delta Advisory Council
	<b>2000</b>	Record of Decision (R.O.D.)
<b>Phase 2</b>	<b>2002</b>	California Bay Delta Authority (CBDA) Act
	<b>2003</b>	
	<b>2004</b>	
	<b>2005</b>	
	<b>2006</b>	CBDA abolished. CALFED to State Resources Agency. Commencement of Delta Visioning Process
<b>Phase 3</b>	<b>2009</b>	

**Fig. 3 – CALFED Timeline.**

these processes, however, the Governor has also ordered studies to begin on the feasibility of a new Peripheral Canal, while avoiding the critical issue of the institutional coordination of the 200 federal and state agencies that share authority in the Delta (Reilly, 2009). It remains to be seen whether these or other efforts will emerge as successors to CALFED's attempts at integrative management.

### **3. Collaboration and adaptive governance: key concepts**

CALFED can be characterized as a collaborative, adaptive, governance process. In this section, we briefly introduce the literature on each of these concepts to ground the interested reader in some of the relevant academic theory.

#### **3.1. Environmental governance**

Environmental governance refers to processes of negotiation, coordination and collaboration between state agencies, private actors and non-governmental organizations directed to the joint realization and implementation of a plan addressing an environmental problem (Jessop, 1998).<sup>1</sup> Govern-

ance processes are polycentric, heterarchic and self-organizing. The definition and the response to a problem are under negotiation, provisional actions emerging through the informal interaction between participants, continuously updated and modified as new information and new interests are brought to the negotiating table (Jessop, 1998). CALFED, especially in Phase 1 (Fig. 3) has been cited as an exemplar of good governance: policymakers, stakeholders and scientists collaborated in ad hoc, self-organizing work-groups under a fluid institutional structure and produced innovative agreements that surpassed long-standing stalemates (Innes et al., 2007).

CALFED is a particular type of environmental governance. First, CALFED is a large-scale process (Heikkila and Gerlak, 2005), as compared to smaller-scale, decentralized governance of common-pool resources, where collaboration may be somewhat easier (e.g. Ostrom, 1990).

Second, CALFED is a multi-scale institution with nested, smaller-scale governance and negotiation processes, such as those of working groups and programs described in some of the articles of this Issue. The contributions to this issue fall out roughly into two broad scale-based categories. Many of the contributions focus on the smaller scale, finer grained analysis of a discrete segment or sub-process, such as the WUE or EWA (Taylor and Short, 2009; Lejano and Ingram, 2009; Fuller, 2009). This level of focus enables insights into the social, interpersonal, and management-level aspects that enable innovation and generation of novel solutions. Other contributions step back and look at a larger spatial/temporal/institutional scale, coarser grained analysis of the "entire" CALFED process, enabling conclusions about the

<sup>1</sup> The term governance is elsewhere used more generally to denote any governing institutional arrangement. For example other articles in this issue refer to "Delta Governance", meaning the institutional organization that will govern the Bay-Delta. In this article we use a scholarly definition of the term referring to heterarchic, polyarchic self-organizing forms of government.

importance of institutional design, boundaries, history, and legal aspects in the evolution of such efforts (Hanemann and Dyckman, 2009; Norgaard et al., 2009; Owen, 2009; Shilling et al., 2009). Both approaches are complementary: although they may not always be easy to reconcile, we embrace the tensions resulting from this juxtaposition of scales of analysis.

Third, CALFED is a cross-scale governance process, i.e. it extends across different levels of social and institutional aggregation (Lemos and Agrawal, 2006; Dengler, 2007). CALFED brought together agencies and actors from the federal, state and local levels, with very different spatial and functional boundaries. It is precisely contemporary large-scale, “wicked problems”, such as the management of land, water and species in the Bay-Delta, whose boundaries are mismatched with the boundaries and assets of existing administrative jurisdictions, that require flexible, integrative, cross-scale institutional arrangements such as CALFED (Kettl, 2006).

### 3.2. Adaptive management

Adaptive management (AM) is a response to the realization that because managed ecosystems are dynamic and unpredictable it is difficult to predict and control their behavior (Gunderson and Light, 2006; Holling, 1978). In AM policies become hypotheses and management actions experiments to test these hypotheses (Folke et al., 2005). AM requires continuous monitoring, evaluation and adjustment of policies. Networks, polycentric governance and collaboration are pre-requisites for good adaptive management (Folke et al., 2005). Scientists assume a “new role” in an AM context, shifting from experts to “one of several actors in the learning and knowledge generation process” (Folke et al., 2005, p. 445). “Adaptive co-management” refers to collaborative programs of adaptation, whereby policy design and evaluation is a joint process. “Adaptive governance” refers to the social and institutional arrangements that provide an organizing framework for adaptive management (Dietz et al., 2003).

CALFED was implicitly, if not explicitly, a grand AM experiment. The Accord (and later the ROD) struck a compromise following the Peripheral Canal and Salinity controversies which was to “wait and see...act and learn”, investing meanwhile in a mix of non-conflictive options from competing proposals, studying the system more and creating an informed agreement later (Hundley, 2001). Specific sub-programs of CALFED, such as the Ecosystem Restoration Program and the Science Program were explicitly built on AM principles (Taylor and Short, 2009).

Gunderson and Light (2006) argue that AM is not just trial and error management or management by objective with evaluation and updating. AM requires large-scale experiments and an acceptance that failures occur but they offer learning opportunities. As in the Comprehensive Everglades Restoration Plan, the other large-scale AM restoration program in the U.S., in CALFED large-scale experimentation, such as significantly reducing pumping and exports, was limited. Furthermore, the “scientific management approach” which requires certitude prior to action (Gunderson and Light, 2006) remained strong throughout; policymakers had

little patience for bad news. While it may be tempting to conclude that CALFED did not measure up to the AM ideal and leave it there, in this article we want to ask how and why AM worked the way it did in the real-world context of the Bay-Delta and California water policy, and thus to engage more with the external limitations and the inherent contradictions of AM.

### 3.3. Collaboration

Collaboration is at the heart of adaptive governance. Collaboration means to co-labor, to work together (O’Leary et al., 2006). It is not merely power-brokerage, i.e. trading among predefined interests to find an optimal point of agreement (Fuller, 2009). Engagement and interaction may create new value and mutual social learning. Collaboration among partners in CALFED is said to have reframed a struggle over water users’ entitlements to the collective question of “what do we want this watershed to do?” (Freeman and Farber, 2005, p. 3). Such reframing allows new ideas to emerge that were not part of a polarized solution spectrum. An oft-mentioned example in this respect is the Environmental Water Account (EWA) (Innes et al., 2007; Freeman and Farber, 2005; Ingram and Fraser, 2006; Lejano and Ingram, 2009). In the EWA environmental and water agencies trade water for fish with water for drinking and agriculture in real time. Innovative ideas like the EWA, some scholars have argued, are most readily conceived through informal interaction between agencies and stakeholders, such as those in the CALFED working groups (Innes et al., 2007; Ingram and Fraser, 2006). Such interaction not only produces innovation but also creates a “cascade of changes in attitudes, behaviors and actions” and “social and political capital” with long-term positive effects (Connick and Innes, 2003).

However in this Issue we want to go one step further, not only in terms of understanding how collaboration works, but also engaging with its “dark side” and shortcomings (McGuire, 2006). Because collaboration is new, or because it produces new results, it does not follow that in and of itself it must be desirable (McGuire, 2006).

Whereas distinctions between collaborative, adaptive governance and hierarchical state regulation and competitive markets are often emphasized, in the real world these three forms necessarily coexist and depend on one another (Jessop, 1998). CALFED for example did not replace but incorporated conventional regulatory agency programs, in the process allowing them to develop new connections and innovations. Governance needs State forms of governing. Court decisions for example formed the background entitlements with which CALFED partners sit at the negotiating table (Freeman and Farber, 2005). State support, financial and symbolic, was crucial and so were state assurances that agreements will be implemented. Furthermore, the State offers a governance process the democratic legitimacy that it otherwise lacks given the ad hoc selection of participants. The downfall of this is that inversely, governance suffers from the shortcomings of State administration and it is vulnerable to external, political changes (Thompson and Perry, 2006). Many of the shortcomings of CALFED, for example, have been related to general problems

of public administration in the participating agencies and CBDA, such as understaffing, budget management processes, competition between state and federal agencies or entrenched agency mentalities (Lurie, 2004). Political changes such as the election of the George W. Bush administration after the signing of the ROD and California's budget crisis shortly thereafter also undermined CALFED (LHC, 2005). However, such changes cannot be viewed as unexpected aberrations that derailed an otherwise successful governance program; in the real world, governments change and crises happen. Nor can government interventions be seen as "messaging" with an otherwise innocuous governance process; governance needs the State. Governance processes therefore have to be studied within their real-world institutional context, and in their real, messy, hybrid form.

#### 4. When and how does collaborative governance and adaptive management work

Networked, collaborative governance arrangements are crucial for a culture and practice of adaptive experimentation (Folke et al., 2005; Gunderson and Light, 2006). Favorable conditions for their emergence include: an impasse which makes warring factions ready to negotiate alternatives (i.e. "fail their way into collaboration", Bryson et al., 2006); a relative balance of legal, economic, and/or political power (Duane, 1997); pre-existing social capital and networks; stakeholders with the resources and expertise necessary to generate new solutions; political mandate, pressure and support; and the presence of – or prospect of access to – external financial resources that would not otherwise be available to participants (Freeman and Farber, 2005; Bryson et al., 2006). These conditions were largely met in CALFED (Innes et al., 2007; Freeman and Farber, 2005). The ballot defeat of the Peripheral Canal and the series of legal decisions empowered environmental groups and created legal and political impasses. Expertise and scientific knowledge were distributed beyond agencies and Universities. Stakeholders had already started networking in the San Francisco Estuary Project and the Three-way process (Connick, 2003). And federal and state leaders, most notably Interior Secretary Bruce Babbitt of the Clinton administration, pushed the process and lubricated it with federal subsidies and state bonds.

If these conditions bring stakeholders to the table for negotiation, they alone are not sufficient to create successful collaborations and partnerships (Fuller, 2009). Innes and Booher (1999) and Bryson et al. (2006) identify several important procedural attributes for effective collaboration such as: the presence of shared practical tasks; initial agreements; a reliance on self-organization rather than an externally imposed structure; the use of high-quality, agreed-upon information sources; proceeding with agreements when there is overwhelming support; external legitimacy of the process; resources and commitment to equalize power differences between participants; continuous trust-building activities, and genuine engagement in productive dialogue. The contributions in this Issue elaborate further how and when collaboration works.

#### 4.1. Looking inside collaborative processes

Contributors heed Agranoff's (2006, p. 56) call to "go beyond heralding the importance of collaborations to look inside their operations." They engage with the question of how and when innovative agreements result, looking at processes and working groups within CALFED that produced breakthrough results, and others that clearly failed (Lejano and Ingram, 2009; Fuller, 2009). Contributions in this issue delve deeper into the question of how collaborative processes work, training a magnifying lens on the mechanics of sub-processes within the larger CALFED program. Their common starting point is that "it is the shared learning process that is critical" (Norgaard et al., 2009).

A critical institutional avenue towards encouraging shared learning is the creation of boundary organizations. These refer to the institutionalized forums where different knowledge and stakeholders work together to bridge the gaps between disparate frames and viewpoints. The Science Program (Taylor and Short, 2009; Norgaard et al., 2009) or the Environmental Water Account (Lejano and Ingram, 2009) served as boundary organizations. They provided opportunities for direct, personal and sustained engagement of scientists and stakeholders, facilitating shifts in concepts and the emergence of new language to talk about problems and solutions (Taylor and Short, 2009).

Within such boundary organizations, boundary objects are used to develop a shared language—an "inter-language" in Fuller's (2009) terms. Boundary objects are "artifacts that individuals work with... that cross disciplinary or cultural barriers" (Carlisle, 2002:446, as cited in Fuller, 2009), such as models, maps, reports, spreadsheets or power point presentations, or even the very conferences and workshops that create a space for shared interaction. Boundary objects offer stakeholders a new vocabulary to talk about problems and a platform for modifying and re-organizing concepts in a way that is acceptable from all perspectives (Fuller, 2009; Lejano and Ingram, 2009). For example, in the EWA, games and modeling simulations of pumping scenarios and their impacts on fish, allowed stakeholders to get a grasp of what water trade meant and offered a base for negotiation and agreement (Hudgik and Arch, 2003; Innes et al., 2007). Identifying commonalities between CALFED and global scientific assessments, Norgaard et al. (2009) underscore how shared language can take the form of a new meta-model or the complementary use of multiple analytical models with different scales or functions as a way to allow participants to communicate across disciplinary perspectives.

However, as Lejano and Ingram (2009) show, the narratives and perspectives of different stakeholders are not reconciled and integrated just through the creation and use of a master frame. It is in the conversation, translation and exchange of different knowledges, i.e. the dialectic juxtaposition of concepts, that "magic occurs", not in the mere combination of the knowledge stored by each camp (Lejano and Ingram, 2009, p. 4).

Yet merely adding a boundary organization or object in the policy mix does not suffice. Whereas the EWA or the Agricultural Water Use Efficiency Committee succeeded, the

Water Use Efficiency (WUE) Program or previous attempts to agree on agricultural efficiency standards, failed (Fuller, 2009; Lejano and Ingram, 2009). Fuller (2009) explains differences between success and failure focusing on the management of the collaborative process. He documents the crucial role of professional facilitators in synthesizing ideas and inventing the new words that constitute the group's inter-language. Maintaining a relationship between the negotiators and their constituencies is crucial for grounding agreements in the political realities of the situation. A question however, is not only how can constituencies feel part of agreements, but how they can become part of the new inter-language developed between those active in boundary work. Fuller emphasizes the importance of a "safe space" of closed doors, whereby stakeholders can negotiate freed from the symbolic roles they have to maintain in public arenas (also Innes et al., 2007). Yet "closed doors" pose a trade-off: they offer a safe environment for negotiation and agreement, but at the risk of estranging outsiders. In the case of the Agricultural committee, this was somewhat managed by the continuous, almost real-time, communication between those in and those out of the room (Fuller, 2009). The danger of a growing disjuncture between those engaged in partnership and those whose interests are being represented always looms and can eventually undermine the legitimacy of a partnership (Jessop, 1998). And whereas some degree of isolation is necessary in order to stabilize a partnership and facilitate focused and timely action, it is also likely to act as a barrier to the recruitment of new partners (Jessop, 1998).

#### 4.2. Institutionalizing collaboration

Lejano and Ingram (2009) locate instead the difference of successful from unsuccessful processes to institutional design. The institutional set-up facilitates or hinders networking and the encounters necessary for the creation of an inter-language (Lejano and Ingram, 2009). WUE was meant to be a boundary organization, but failed because its regulatory design in the form of a centralized, coordinating body implementing and overseeing a set of predefined "Best Management Practices" did not provide opportunities for communication, mediation and translation of information between stakeholders (Lejano and Ingram, 2009). Perhaps counter-intuitively, new institutions may have better results as boundary organizations, as they do not bring the 'baggage' of familiar way of doing things and thus are more conducive to new ideas (Lejano and Ingram, 2009). Furthermore, the important feature of design may not be so much its form, but its practice; EWA ostensibly a market design, functioned well because it worked in a non-market way, i.e. through personal interactions and information not bounded by a pricing signal (Lejano and Ingram, 2009).

This insight from smaller-scale processes within CALFED echoes the debate about the institutional form of the program as a whole. The issue there was whether CALFED after the ROD agreement should be governed as a program by a dedicated agency or that instead it should continue to be more of a voluntary, fluid structure of working group

exchange, coordinated by a high-level Policy Group. The argument in favor of a centralized, coordinating body was that it was necessary to offer assurances for the implementation of the agreements and political responsibility and accountability for the vast amounts of money managed. The counterargument was that the institutionalization of CALFED in a coordinating regulatory agency, would choke off the innovativeness of ad hoc partnerships, increase bureaucracy, reproduce the problems of agency-based public administration and create competition between existing agencies and the new agency. While some argue that this is precisely what happened with CBDA (Innes et al., 2007), others argue that the problem was precisely the opposite, i.e. that CBDA did not have enough power over the agencies in terms of managing the funds and assuring implementation (Bobker, 2009; LHC, 2005).

This tension between governability and accountability on the one hand and flexibility, creativity and adaptability on the other, has been noted elsewhere (Jessop, 1998). Internal accountability within the process, i.e. each partner being watched by all others (Freeman and Farber, 2005) does not solve the problem of external accountability, i.e. the risk of exploitative capture of public resources by the partnership as a whole (Jessop, 1998). Yet conventional institutional forms of external accountability, such as an agency with a funding program, reduce the self-organizing flexibility and cross-partner communication that are the heart of collaboration (Jessop, 1998). A key research question then concerns the possible institutional designs that can provide accountability, stability and governability without killing the flexibility necessary for continuous learning and adaptation.

#### 4.3. From learning to practice

Taylor and Short (2009), analyzing the Science and Ecosystem Restoration Programs, raise a point overlooked by other contributions focusing only on shared learning; the possibility that the creation of a new language and new understandings may not automatically translate into concrete actions that solve the problems at hand.

Further analytical work is needed in the knowledge generation literature to address the need to move developing shared understanding and to shared capability to apply the understanding in a problem-solving mode (Taylor and Short, 2009). Central here is the role of "bridge researchers", individuals who understand how agencies work and switch roles between research and implementation agencies, cross-transferring new information and emerging understandings (Taylor and Short, 2009). Studies of collaborative governance in the Everglades confirm the critical role of such "super-agents", knowledge-brokers who serve in multiple leadership roles of participating organizations, inhabiting multiple knowledge spaces and helping bring them together (Dengler, 2007). Importantly, such "leaders" in the Everglades had personal connections and the capacity to communicate the knowledge generated in the process to powerful state and national politicians ultimately responsible for the funding and authorization of collaborative plans (Dengler, 2007).

## 5. Fundamental limitations and challenges

### 5.1. Evaluating governance

The inability to demonstrate tangible results for the \$3 billion invested in the program was a central reason for CALFED's dissolution (LHC, 2005). But did CALFED fail or succeed in ways that were not immediately obvious? Some contributors in this Issue refer to the deterioration of environmental conditions and the lack of progress in supply reliability and seismic vulnerability as signs of failure. Others point to innovative agreements, unprecedented dialogue and new understandings as signs of success. Many would agree with Bobker's (2009) argument that CALFED succeeded in transforming cultures, processes, languages and understandings but failed in delivering the desired management and policy outcomes.

Bobker (2009) makes a distinction between process as the means, and substantive goals as the ends of a policy. However, such a distinction between procedural means and substantive ends is hard to maintain. Governance emerges precisely to negotiate disagreements over incommensurable ends and to deal with the immense complexity of the system that makes hard any assessment of whether it gets better and why. For example, it is still contentious whether the decline in Delta smelt is indeed an indication of the environmental health of the system. Even less certainty exists over the causes of its decline; pumps and water exports seem to play an important role but noise from natural, long-term variations and synergies with other factors such as pollution, invasives or in-Delta water uses are hard to establish. Even more difficult would be to weigh – uncertain or temporary – improvements in some goals (e.g. salmon populations) against – uncertain or temporary – deterioration in others (e.g. water exports). Process in this sense has a value in and of itself. Continuously negotiating, learning and adapting goals and metrics in the face of disagreement and changing conditions is a sign of success from governance's own logic (Jessop, 1998). Hence, Connick and Innes (2003) propose a new set of evaluation criteria for collaborative processes such as production of "high-quality agreements", "innovation" or "learning".

Evaluating governance in its own terms however is also unsatisfactory: Bobker (2009) points out that procedural benefits should ultimately produce substantive improvements to the managed system in a politically acceptable timeframe. External accountability of the partnership needs a set of external goals, other than the presence of the partnership itself, upon which its performance can be evaluated.

The question of how to evaluate collaborative governance and adaptive experiments cannot be resolved by theory or in the abstract. It is through a pragmatic mix of both procedural and substantive evaluations (Bryson et al., 2006), internal and external to the process, that the accountability and legitimacy of a collaborative process can be – always provisionally – maintained. The research task here is to collect the experience with evaluation practice and problems from different collaborative governance and AM experiments around the world, and draw lessons about which evaluative arrangements work best, at what scales and under what geographical and socio-political conditions.

### 5.2. The dark side of collaboration

Exposing the "dark side of networks" (McGuire, 2006), Shilling et al. (2009) argue that CALFED process fortified the privileged access to California's water policy by the "iron triangle" of agencies, urban users and irrigated agriculture, together with the emergent power of mainstream environmental groups. In the process, weaker actors were marginalized, including the broadly defined Environmental Justice (EJ) community representing low-income groups, small farmers, native communities, people of color, and more radical environmental interests. Authorities treated EJ issues uncomfortably, delegating them to a specialized workgroup with an unclear mandate, little influence on decisions and isolated from the rest of CALFED (Shilling et al., 2009). Shilling et al. highlight the difference between collaborative governance CALFED-type and "participatory governance" (Fung, 2006), defined as "the active involvement of citizens in government decision-making" (O'Leary et al., 2006, p. 7). Public overseeing committees with open meetings, such as the BPAC and the EJ working-group, did not provide real citizen input and remained peripheral to the process (LHC, 2005; Shilling et al., 2009).

Shilling et al.'s (2009) findings speak to a broader literature critical of collaborative governance which argues that rather than democratizing decision-making, collaborative arrangements increase democratic deficit by strengthening those who are able to exercise greater access and expertise in relation to the new governance mechanisms (Lemos and Agrawal, 2006; Swyngedouw, 2005). These critical works call into question the legitimacy and representative accountability of the powerful NGOs that come to speak for citizens or the environment in these processes (Swyngedouw, 2005). They also show how the new inter-language that emerges within collaborative processes is, first, partly conditioned by the initial framing, mandate and participant composition of the process, and second, privileges those actors who are willing to accept it and "play by the rules", while marginalizing those with more radical views (Swyngedouw, 2005; de Angelis, 2003). From this critical perspective, solutions such as the EWA, which appear to collaboration scholars as innovative and consensual (Lejano and Ingram, 2009; Innes et al., 2007), are seen instead as an expansion and legitimization of the dominant market logic and language to the environmental realm, perpetuating past injustices (Gibler, 2005). With the EWA for example, environmental agencies are forced to think in market terms and trade what previously was a nonnegotiable regulatory limit for protecting endangered species (Gibler, 2005). Worse, agribusinesses get paid by taxpayers to give up water that they received subsidized from the State (Taughner, 2009).

Others see such arguments as overblown. In their view, first, collaborative governance is a pragmatic response to a resource conflict, and it makes sense to involve primarily those with power to end a stalemate (Fullerton, 2009). The EWA, for example, even if unfair from a historical perspective, was the only feasible solution to a stalemate where agricultural interests refused to give up their water rights, environmental agencies had problems limiting water pumping, and courts offered unpredictable solutions devoid of nuance and

satisfactory to no one (Innes et al., 2007; Freeman and Farber, 2005). Second, the groups that fail to access collaborative governance typically have also limited access to the arenas of representative democracy too. Third, collaborative governance after all is not meant to substitute, only complement, institutions of representative democracy, such as the legislature (Fullerton, 2009).

This is, however, a rather simplistic view of the complex interaction and articulation between representative democracy and collaborative governance (Swyngedouw, 2005). Governance processes, as evident in CALFED, leave much to be desired in terms of transparency, accountability and public oversight, and this partly has to do with their very nature that rests on informal, ad hoc and closed-door interactions. Governance is not a risk-free complement to conventional governing institutions. First, governance takes time and money out of normal governing from agencies with stripped financial and human resources. Second, governments may use governance processes to evade taking controversial decisions (Hanemann and Dyckman, 2009) or to diffuse political responsibility and accountability. Or in other instances, they may tactically use it to rubber-stamp controversial decisions, justify exclusion of uncooperative actors or even scapegoat collaboration itself, offering a pretext for return to authoritative modes of governing (Swyngedouw, 2005; de Angelis, 2003).

Beyond this fundamental debate, some argue in more pragmatic terms that unless those with marginal, extreme views (on both “sides” of the spectrum) are left out of the negotiation there is the risk of reproducing sterile philosophical debates, increasing frustration, and derailing action (Innes et al., 2007). Yet this view of democracy is in tension with the view of a discursive democracy held by Norgaard et al. (2009) as one that puts fundamental philosophical and value standpoints under deliberation. As Swyngedouw (2005) argues, politics is precisely about debating fundamentals and exposing conflict. It is in this sense that Norgaard et al. (2009) argue for engaging deeper into the conflicts swirling around the Bay-Delta with the fundamental tensions of inclusive, deliberative processes rather than shying away from them. The question is how to enhance the democratic and inclusive character of processes like CALFED and how to develop effective bridges with other forms of governing (government, legislature, courts, etc).

### 5.3. Distribution, governing and governance

A broader notion of ‘justice’ includes the distribution of the costs and benefits of environmental change between different groups (Shilling et al., 2009). Hanemann and Dyckman (2009) argue that negotiation over Bay-Delta ecosystem’s goods and services is fundamentally a zero-sum game. The literature on collaboration suggests that by bringing adversary parties together, either win-win solutions can be devised, or that adversaries will see the problem differently in ways that will shift the focus from trading interests, to achieving shared benefits (Hanemann and Dyckman, 2009; Fuller, 2009; Freeman and Farber, 2005; Connick and Innes, 2003). Yet the presence of a sufficiently large win-win space of shared benefits cannot be assumed *a priori*. Hanemann and Dyckman

(2009) make a strong empirical-historical case that the Bay-Delta involves a fundamental opposition of interests. Yet other contributions describe smaller sub-processes initially considered zero-sum in which mutually beneficial agreements were reached (Fuller, 2009; Lejano and Ingram, 2009). A remaining question is whether such win-win agreements amounted to much more than “tinkering at the edges” (Fullerton, 2009, see also Owen, 2009; Brown and Kimmerer, 2009). Second, it seems that the win-win space for these agreements may have been built by state subsidies, with the tax-payers as potential losers unless the agreements delivered collective benefits. It is reasonable to extend with the arguments of Hanemann and Dyckman, and argue that solving the problems of the Bay-Delta, like many other environment-development conflicts around the world, involves fundamental choices concerning what should a desirable ecosystem look like, who gets to do what with their land and water, who pays and who benefits. CALFED failed in dealing with these core issues, as manifested in the failure to establish a user-fee arrangement to finance the program (LHC, 2005). Hanemann and Dyckman (2009) conclude that it is ultimately the responsibility of the State to make tough distributive choices about the collective good. Collaborative efforts may be symptomatic of policy-makers avoiding hard decisions.

A criticism of this “return to State authority” thesis is that mediation and collaboration in CALFED itself arose from endless rounds of litigation sparked by decisions the State *did* make. It is not clear how greater State “decision-making capacity” can overcome such fragmentation of interests unless greater raw power is exerted to suppress those whose interests would suffer. Furthermore, the story of the SWRCB (Hanemann and Dyckman, 2009) may be read not so much as a lack of authority, but as its selective (mis)use: when the SWRCB was ready to use its authority and set limitations to water users in 1985, the Governor used his to maintain the status quo.

Calls for greater state authority (e.g. LHC, 2005) underplay that States are not infallible, even when they do have and exercise decision-making capacity (the U.S. Federal Reserve and the recent financial crisis are obvious examples). They also ignore the broader political-economic context of free market (neo-liberal) policies in the 1980s and 1990s that deliberately weakened State capacities to govern public goods, such as environmental protection. Beyond calls for a shift from governance back to government and calls for authority and leadership (LHC, 2005), what is needed is a strengthening of the capacity, political responsibility, accountability and representative character of conventional government, a prerequisite for meaningful collaborative governance too. Governance is not a substitute for a good, fair and effective government.

### 5.4. Control and adaptation

Owen (2009) makes the provocative argument that even if it endorsed an experimental approach, CALFED was rooted in the belief that the Bay-Delta can be re-engineered and controlled to the limit to satisfy competing needs. His work points to an interesting contradiction within the logic of AM in

that while AM recognizes the inherent uncontrollability of complex socio-ecosystems, the objectives of experimentation are ultimately to improve our capacity to understand and better control the system. Owen instead espouses a precautionary approach of limiting human intervention on ecosystems given the limitations of our understanding. In the case of the Bay-Delta this includes reducing water consumption and withdrawal, though one could extend the argument to include, more generally, reductions in the emission of pollutants or controls to the urbanization of the Delta. Interestingly, Owen does not base his argument on a romantic environmentalist ideal of untouched ecosystems as being inherently better. His argument is that reducing the intensity of consumptive uses of the Bay-Delta is likely not only to improve environmental conditions, but also to increase the stability and reliability of consumptive patterns, although at a lower level.

An AM experiment that could have improved the ecological conditions of the Delta may indeed have entailed reducing diversions dramatically, reconvertng much of the farmland in the watershed to habitat and/or eliminating most toxic discharges in the basin (Fullerton, 2009). No experimentation was made with these most significant management 'knobs', not only because of entrenched interests or risk aversion of decision-makers; as Fullerton (2009) argues stopping water flowing south is simply a politically infeasible option and eventually a socially unpopular one given that most Californians are unlikely to trade their material standards for environmental benefits. The AM literature overlooks such real-life constraints to experimentation and does not entertain the possibility that under multiple, incongruent goals and constraints the spectrum of experimentation might be very limited.

Furthermore, whereas the AM literature assumes that collaboration and networking are good for experimentation, CALFED shows that collaboration by its very nature tends to sideline the more radical political options for the sake of common ground. Innovation therefore is permitted within a limited, potentially win-win space, while radical innovation *a priori* excluded. Others too have noticed that whereas collaborative governance may produce agreement over techno-managerial solutions that promise to improve the efficiency of resource use it is unlikely to promote more radical options that involve restraints in human consumption (Lemos and Agrawal, 2006). This begs the question concerning the type of State-governance arrangements that may produce the radical experiments and changes that might be necessary not only in the Bay-Delta, but more generally with respect to climate change and the other environmental crises that economic growth and rising consumption are producing.

## 6. Conclusions

CALFED helps us see the benefits of collaborative, adaptive governance and what it takes to achieve them, but it also helps us see some limitations. Informality, self-organizing interaction and sustained boundary work are some of the conditions for success. Less clear is what sort of institutional designs can create and maintain these conditions, while assuring that agreements will be implemented in a publicly and politically

accountable way. The interactions and division of responsibilities between new forms of governance and existing forms of governing emerge as a key question; governance may be capable of generating new and innovative ideas, but appears ill-suited for dealing with core distribution issues that are at the heart of water conflicts. The democratic deficit of governance processes further undermines their legitimacy in resolving distributive dilemmas. Governance is no substitute for governing and the need to reform and improve the accountability, effectiveness and inclusiveness of conventional government. Research needs to go beyond treating collaborative and adaptive governance as distinct processes, celebrating their successes or exposing their failures. The task ahead is to rethink the boundaries of governing and governance and imagine and evaluate effective arrangements that distribute functions appropriately optimizing results.

Furthermore, it might be wise to start thinking whether slowing down the drivers of change might be more appropriate rather than attempting to live with optimized but imperfect governance. Stakeholders in the Bay-Delta have reached the painful realization that they cannot have it all. Environmental conservation or restoration and further growth appear fundamentally at odds. Climate change and resource depletion suggest that current levels of consumption in the developed world may be unsustainable in the longer term. A reduction in consumption patterns might not only reduce environmental pressures, but also vulnerability, securing the reliability of infrastructures and consumption at a lower level (Owen, 2009), sufficient to satisfy basic needs. Nonetheless, radical changes reducing consumption and slowing growth appear politically and socially impossible, if not utopian, within present forms of representative government and governance, alike. The question then concerns the type of democratic institutions and political reforms necessary to facilitate such radical, yet necessary, changes in California and elsewhere.

## Acknowledgements

This paper benefited from the comments of Boyd Fuller, Dave Owen, Helen Ingram and Raul Lejano. We are grateful to the authors, commentators, and reviewers for their strong contributions to this Special Issue, and to everyone involved for their patience and support.

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