INTRODUCTION

The Challenges of Adaptive Governance

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GROWTH AND DEVELOPMENT in twenty-first century America impose increasing stress on natural systems, which in turn increases conflicts among the diverse users of these systems. Problems among water users are evident even in states like Florida with abundant rainfall: declining water levels and saltwater intrusion in wells, polluted and diminished flows in springs and rivers, collapse of sinkholes, dried marshes, disappearing lakes, red tides, and habitat destruction, and other problems documented in the case studies in this volume. Scientific study of natural ecosystems is increasing our awareness and understanding of these problems and of possible solutions, but even advanced ecological knowledge has limited power to help resolve conflicts among competing demands for resources.

Problems on this scale inevitably involve collective action challenges of great complexity. Current governance structures are often the product of successful attempts to resolve collective action problems among users of a single type (e.g. urban, industrial, agricultural). This volume focuses on adaptive governance**,** which we define as a new generation of governance institutions for resolving collective action problems that occur between different types of resource users. Water quality, water supply, and habitat conservation are often the province of specialized authorities at local, state, and federal levels that support successful exploitation of water resources. Ironically, the very success of these specialized agencies brings about the expanding range of water conflicts that we study—conflicts that emerge as decisions by one authority impact other authorities and the users they govern. We call such conflicts second-order collective action conflicts, in contrast to the often simpler first-order conflicts that the specialized authorities were created to manage.

These second-order conflicts tend to be geographically defined by an integrated natural system—a river, an aquifer, a natural watershed—governed by

multiple agencies. The evolving decision processes often utilize collaborative techniques from the field of conflict resolution. Such innovative processes have multiplied in recent decades (Bardach 1998) and are now a significant presence in natural resource governance (Wondolleck and Yaffee 2000). Our goal is to understand the challenges facing these innovative processes, and how they can help current institutions adapt to emerging second-order collective action problems.

Our concern with adaptive governance parallels adaptive management in developing techniques to deal with scientific uncertainties, as we discuss later, but extends them to include uncertainties about human institutions as well as the natural system. Sustainability requires that the two be compatible, and at times it may be more prudent to experiment with human than natural systems. Adaptive governance also aims to resolve conflicts among competing users in a manner that enhances joint gains while minimizing negotiation costs, but emphasizes that the resolution of conflict in the human system is valuable only if it leads to sustainable use of the natural system.

New Water Conflicts and the Second-Order Collective Action Problem

For most of the twentieth century, federal governance of water was dominated by development-oriented projects to increase the efficient use of water for specified purposes—projects that all congressional representatives sought for their own districts (Milbrath and Goel 1977; McConnell 1966). The U.S. Army Corps of Engineers and the U.S. Bureau of Reclamation developed the expertise and political base to design and build large projects that exploited apparently unused water resources to provide agricultural irrigation, hydroelectric power, and navigation (Reisner 1986). In areas of over-abundant water, canals were built to drain lands for agriculture and provide navigation (Blake 1980).

During the last quarter of the twentieth century, this development orientation came into increasing conflict with health and environmental concerns, which spawned new specialized agencies including the U.S. Environmental Protection Agency (EPA) and state counterparts like Florida's Department of Environmental Protection. Governance issues shifted to means of ensuring water quality with the Federal Water Pollution Control Act (U.S.C. §1251 et seq.): Congress began large-scale financing to help municipalities upgrade public waste treatment facilities, while EPA rules determined the kinds of investments required by private dischargers into surface waters (Rothenberg 2002; Clark and Cantor 1997). In addition, environmental concerns about the impact of water quality on endangered species brought new agencies like the U.S. Fish and Wildlife Service and state counterparts into water governance.

This shift to environmental issues mirrored the shift in political power away from agriculture and toward the cities and then to the suburbs, where environmental quality and the recreational use of water are valued as much as its economic development (Rothenberg 2002). In Florida, the state we feature in our case studies, the longtime dominance of politics by agriculture and the northern panhandle counties gave way to the rapidly growing cities in the south. The combined shift in

issues and demographics continues to play out in the water conflicts that we study, complicating the use of adaptive governance to resolve complex governance issues (DeHaven-Smith and Colburn 1999; DeGrove 1984; Pelham 1979).

Conflicts that arise under conditions of stress on the natural system frequently arise because of unexpected responses from the natural system, and require the affected agencies to deal with unfamiliar issues beyond their established expertise. They frequently involve new stakeholders, unfamiliar with the agencies' procedures, who challenge existing policies and established procedures. Conflicts among governing authorities create ambiguity about the proper arena for resolving the conflicts and solving the underlying problems. Coordinating policies across fragmented arenas could produce considerable benefits for stakeholders jointly affected by the decision of specialized authorities, but this requires combinations of expertise, authority, and representation of users that are not yet an established part of the institutional structure governing water resources.

Florida's Water Conflicts: the Case Studies

Of course, conflict is nothing new to observers of U.S. water policy. Water policy in the arid western states was in open conflict a century before the riparian east was forced to think in such stark terms. Today, however, there is no quarter of the United States in which water remains an abundant resource with effectively infinite assimilative capacity and the ability to readily satisfy the needs of all user groups. Lines of battle abound; many points of view compete for our understanding of who owns water, who should have the right to use it, what technologies are appropriate to employ, and what user risks are acceptable (Young 2005; Blomquist, Schlager and Heikkila 2004; Dzurik 2002; Ingram 1990; Maass and Anderson 1978).

Nowhere in the eastern U.S. is water more the subject of controversy than in Florida. Exuberant population growth and economic development, coupled with fragile groundwater stocks and delicate ecosystems, make Florida a center of tensions between the development industry and the environmental movement. It was in Florida that some of the earliest battles between development and preservation interests were played out: in the 1960s, proposals for an Everglades jetport and for a Cross-Florida barge canal led to national changes in environmental politics (Purdum 2002: Fernald and Purdum 1998).

Despite the battles over water rights, Florida's water policy has a history of innovation. It was in southern Florida that many of the technological challenges of canalization and wetland dredge-and-fill were first overcome. The state has the nation's most aggressive desalinization program and the most ambitious plan for developing aquifer storage and recovery systems. Greywater reuse, sprayfield disposal, and deep well injection were pioneered here. The state's regional water management districts have provided a national model for resource basin-based decisionmaking. Some of the nation's earliest and most notable multiparty collaborations in water policy were accomplished here, providing early examples of successful adaptive governance.

In short, institutional responses to Florida water conflicts illustrate both the challenge of political fragmentation of authority and the promise of pragmatic

American problem solving. The eight Florida case studies assembled in this volume offer a wealth of empirical richness about the second-order collective action problems confronting communities in all states. By selecting only Florida cases, we can provide essential details of the framework of conflict while sparing readers the considerable institutional complexity across 50 different state environments. Although the study context resembles the eastern more than the arid western states, we believe that the adaptive governance challenges analyzed here are relevant throughout the nation and across all natural resource issues. We hope that Florida's position at the leading edge of eastern states water conflict will more than compensate for our exclusion of the better-known first-order western water conflicts.

Each case examines conflicts in which multiple authorities confront novel situations that challenge existing procedures and authorities. Throughout this volume we will refer to cases by italicizing the place name from the table of contents. Two cases involve disputes over water quality: Fenholloway illustrates the expansion of conflicts over discharges permitted by private companies, and Suwannee illustrates the agricultural community's responses to increasing requirements to control previously unregulated non-point source pollution. Two of the cases, Tampa Bay and East Central Florida, focus on conflicts over water supply among competing municipal users. And finally, four cases explore conflicts involving the intricately connected aspects of water systems and habitat restoration. Ocklawaha explores the issues of removing a dam whose original purpose has disappeared. Apalachicola documents the tri-state dispute over allocations of water for different users and habitat preservation in the Apalachicola-Chattahoochee-Flint river system. Acquifer Storage, the exception to our place name reference because it applies across the state, explores efforts to expand use of a relatively new technology for underground storage of water. Everglades considers the Everglades restoration, the granddaddy of all Florida water conflicts involving almost all stakeholders and water issues in the entire region of South Florida.

The types of institutions and stakeholders vary across cases. Some conflicts bring the state legislature, administrative offices, and courts into novel situations. Most involve "advisory processes" with different levels of statutory guidance, ranging from ad hoc meetings to expanded interpretations of existing permit writing procedures and rulemaking authority to custom-designed statutory approval from the Florida Legislature and the United States Congress. Some decision processes attempt to forestall future conflicts, future regulatory expansion, or future challenges to permit decisions. Some institutional innovations appear to provide stable resolution of underlying conflicts, while others have failed and have perhaps exacerbated conflicts.

Adaptive Governance

As second-order conflicts have grown over the past decades, some specialized resource managers have adopted the tools of adaptive management (Gunderson et al. 1995; Lee 1993). Adaptive management focuses on the problem of managing resources when faced with inadequate knowledge and uncertainty about the

natural system—we refer to this below as the challenge of scientific learning. A set of analytic and administrative tools let managers utilize the experimental techniques of science to test policy hypotheses during implementation. Policy then adapts to new knowledge about the natural system. Adaptive management techniques are particularly useful where there is broad agreement on policy goals but not about the appropriate means to achieve these goals. Scientific experimentation may then settle disputes about the most effective means.

Adaptive management fits well with the popular view of democracy in which elected officials determine policy goals, and specialized authorities then resolve conflicts about means. But the new water conflicts generally belong to the class of "wicked problems" (Rittel and Webber 1973) that do not fit this view because goals and means are inseparable. The policy tradeoffs involve a complexity of both human and natural systems that strains the ability of legislatures to make meaningful decisions to guide the adaptive management process.

If adaptive management seems ill-suited to the resolution of second-order conflicts within the existing political framework, conflict resolution suggests an alternative basis for adaptive governance of natural resources: bring the critical users, experts, authorities, and organized interests together into specialized negotiating frameworks designed to elicit mutually advantageous agreements. The well-developed study of negotiations and settlements can tell us much about adaptive governments, particularly the design of discussion forums.

But resolving the conflict among well-organized interests and competing authorities is not all that is involved in a sustainable resolution of current and predictable future conflicts. In order to be relevant to adaptive governance, conflict resolution must deal with limitations of both the human and natural systems. Solutions must account for not just the likely responses but also surprises from the natural system—the primary concern of the adaptive management approach. They must earn support not only from participating interests and authorities, but also from affected users and the broader political system. To provide sustainable solutions in the face of uncertainties about both the human and natural systems, second-order conflicts may require fundamental changes to governing institutions, changes that enhance the adaptive capabilities of the system without destroying the capabilities of agencies to manage resources effectively within the limited scope of their authority.

Adaptive governance, then, involves the evolution of new governance institutions capable of generating long-term, sustainable policy solutions to wicked problems through coordinated efforts involving previously independent systems of users, knowledge, authorities, and organized interests.

The contributors to this volume believe that successful governance of water and other natural resources in the twenty-first century depends on our ability to create adaptive institutions, and that this ability will depend on resolving five challenges to adaptive governance:

1. Representation (Who should be involved?)
2. Decision Process (How can authorities and involved stakeholders reach policy agreements that serve them well?)

3. Scientific Learning (How can policy makers develop and use knowledge effectively?)
4. Public Learning (How can resource users and the relevant public develop common understandings as a foundation for consensual policies and policy processes?)
5. Problem Responsiveness (How well do decisions achieve natural resource management goals, including sustainability, equity, and efficiency?)

1. Representation

The first challenge is to determine who should be represented in the new procedures and institutions, with what resources, and with what authority. Conflict arises from the harms imposed on some users by others. To resolve conflicts within the political system, the harmed users must identify the source of harm, articulate their interests, and create political alliances able to change existing rules and authorities (Easton 1965). But identification, articulation, and aggregation of interests are all subject to the collective action problems involved in getting individuals to work together (Olson 1965), which may leave the political landscape dominated by organized economic interests. When different types of affected users remain unorganized or ineffective participants, should adaptive governance institutions proactively expand representation?

Why is adaptive governance concerned about representation? In the democratic ideal, citizens have equal access to decision processes intended to change public policies, although this ideal is seldom realized. Pragmatically, greater representation may help obtain needed resources and reduce challenges from represented interests (Flyvbjerg 1999; Moe 1980; Wengert 1971). The standard of representation in localized, ad hoc decision processes must be acceptable to the greater political community to avoid being overturned by administrative, legislative, or judicial institutions (Meyer 2001). Furthermore, broader representation may transform issues and make broader, mutually advantageous tradeoffs possible (Susskind 1981; Pateman 1970).

On the other hand, broader representation also complicates the negotiation process. Processes with more parties may require more formality, share fewer common perspectives, develop less personal trust, and increase the time required for deliberations, all of which may undermine the critical belief by participants that the process will be fruitful, particularly if some of the included groups are clearly hostile to the process.

2. Process Design

The second challenge is to develop decision mechanisms that satisfy the groups involved in the process. Effective representation requires a reasonable understanding of what the represented group prefers over a likely range of policy outcomes, an ability to translate these preferences into policy options, and resources

and skills to gain approval of preferred policies. When representatives have restricted access to information, technical knowledge, and decisionmaking, participation can be simply a façade used to claim legitimacy. Purely advisory deliberations may have little impact on final decisions made elsewhere (Harter 1992; Arnstein 1969).

Full voting rights do not guarantee a working process. Too often, the normal venues for developing policy options operate without sharing information. Too often, they do not facilitate innovative problem solving. Too often, solutions do not endure. Through the 1980s, experiments with "win–win" process designs led to proposals for new participatory frameworks that emphasized cooperation over competition. These experiments, including negotiated rulemaking, policy dialogues, and various mediated forms, became more widespread in the 1990s, but vexing questions remain (Forester 1999; Innes and Booher 1999). How can scientific and technological knowledge be made accessible to unsophisticated interests, and how can technical creativity overcome partisan agendas? How do these new participatory structures interact with traditional decisionmaking authorities and political leadership? Should government agencies—frequently the primary participants in collaborative institutions—have a different status than water users?

What role should leaders, administrative authorities, facilitators, and public interest groups play in developing representation for unorganized interests (Jones et al. 1992; Shaw 1988)? What qualifications should be required of paid experts, public interest groups, or self-appointed representatives who undertake such work? Are they sufficiently knowledgeable about the issues to develop positions, defend them against opposition, and incorporate the detail necessary to make them viable within broader policy decisions? Since these are particularly important in the ambiguous and unstructured settings in which the new water disputes arise (Rubin and Sander 1988), can safeguards be developed to protect the legal rights of stakeholders in nontraditional proceedings?

Process design also affects the accountability of representatives to the group they represent, and hence the legitimacy of decisions approved by representatives. For example, the transparency of fully public proceedings may ease the concern that representatives may sell out their constituency. Of course, public negotiations in partisan settings may also unduly constrain the delicate processes of compromise and creativity. In addition, transparency is elusive for many complex technical issues of water governance; neither constituents, nor their local, state, or federal elected representatives, nor the media have the time, expertise, and inclination to observe and interpret the technical discussions among experts. Even if they did, the scientific and technical uncertainties inherent in the majority of policy decisions could make constituents doubt the sincerity of their representatives. This is particularly true for adaptive governance techniques in which decisions are expected to change in response to new knowledge. Since unanticipated consequences and the resultant policy changes generally affect the distribution of costs and benefits, constituents may question how well they were represented in the initial decision. Promoting trust and accountability between representatives and their constituency while allowing the flexibility required for developing innovative, adaptive policies (Bianco 1998) remains one of the most critical and least understood challenges of process design.

3. Scientific Learning

Science is critical for much of environmental policy. Water policy questions are often steeped in hydrology, geology, and more recently in a wide range of life sciences. Yet the policy process is not sophisticated in its understanding or use of science. Sometimes policymakers and stakeholders expect science to speak with a single voice, and to have answers readily available. Often they expect a higher degree of certainty than scientists can offer, particularly when available data do not allow the specificity that policymakers require (Adler et al. 1999; Nelkin 1992; Ozawa 1991). Often policymakers are asked to decide questions when the scientific community would prefer to assemble more data. This leads to appeals for delay, to expenditure of scarce resources for data collection that might otherwise be deployed in program implementation, and to decisions that do not enjoy the full confidence of interests.

Policy processes that complement the norms of scientific progress and knowledge are more likely to use science effectively. At least three dimensions are important. First, different specialists reflect different perspectives on the human and natural systems. Decision venues that clarify and contrast differences may lead to productive syntheses, but may also exacerbate conflicts. Second, policy processes can advance scientific knowledge by providing a forum for experts to review existing results and design research projects to fill gaps. Finally, policy decisions may be structured as scientific experiments in which outcomes are monitored to test the critical assumptions on which the policy rests, as envisioned in the adaptive management literature.

These concerns raise many questions about the role of science in adaptive deliberations. What kinds of information are used in the decision process, and from what sources? How are scientific conflicts resolved, including disagreements over data, methods of analysis, and underlying theories? How should decisionmakers and stakeholder representatives be involved in determining which issues to resolve and how to resolve them? Is science biased: who are the scientists? Who pays them? Are "independent" scientists active in policy-related research? How influential is scientific analysis, and how is it integrated into the process? Does a technical focus on "science" exclude other valuable knowledge from resource users?

4. Public Learning

Policy deliberations often involve a relatively small number of elites, frequently representatives from associations and organized interests that seek to represent resource users or other stakeholders (Ostrom et al. 1994). Implementation of agreements, however, will generally require the cooperation of users themselves and the resources and legitimacy from political institutions and a broader section of the public. To what degree can we expect adaptive governance to lay the groundwork for such cooperation through the process we refer to as public learning?

Public learning implies that users learn about the broader consequences of their actions, the reasons for restricting particularly harmful actions, and the available alternative policies that reduce harms and enhance benefits. It is equally important that they accept the legitimacy of the decision process itself and the lessons learned by stakeholders about conflicting demands on water resources and how to resolve them.

The general public and the primary political institutions (legislative, executive, judicial) are involved in public learning as well. They will control what resources of authority and funding can be used to implement the agreement, and what alternatives are available to disgruntled stakeholders who wish to challenge the agreement. The political institutions and the public segments they respond to ultimately determine the long-run legitimacy of these decision processes and the policy decisions they make. Education of stakeholders reshapes the nature of the conflict; education of the greater public redefines the context in which the conflicts are played out.

Public learning also includes the process by which individuals and society learn to value new outcomes and the decision processes that can bring them about. This type of public learning centers on how resource users, experts, authorities, and organized interests can explore and change—some would say transform—their understanding of the legitimacy of opposing interests and the effects of their own behaviors on the resource stocks and flows. This is an old concern of political theory, eloquently described by J.S. Mill in the nineteenth century as "social development" (e.g., Mill 1962). But it is also a key concern in recent planning theory (Hillier 2002; Healey 1997; Friedmann 1987). For example, Meyer (2001) argues that local communities are increasingly likely to organize to oppose federal restrictions imposed to protect endangered species, in part because of different perceptions about the resilience of nature and the rights of property owners and local communities to exploit local resources. Long-term resolution of conflicts—particularly those involving habitat conservation—relies in part on the transformation of beliefs about the natural system and about the legitimacy of restrictions and the process that produces them.

How can decision processes foster exploration of beliefs and preferences by user groups and the general public, and at what cost? The authors in this volume will explore the characteristics of arenas for public discussion that transform the perceptions and preferences of the public and reshape the underlying conflicts. How does new information emerge and affect public debate and policy decisions? Does the process lead to surprises for stakeholders and the general public? Do these surprises change beliefs and preferences? How is the press involved? How can representatives transform the preferences of their constituency rather than just reflecting unconsidered preferences and beliefs?

5. Problem Responsiveness

Decision processes are judged by how well the policy decisions and implementation respond to the underlying source of conflict. The policy sciences have long assessed public policy in terms of economic efficiency and equity, and these

remain central to our view of whether any given water policy deliberation or institutional change is successful. Sustainability has recently become a central test of the environmental consequences of policy.

Efficiency is traditionally viewed as the promotion of greatest benefits to the largest portion of the public, a goal that defies simple calculation. Pareto's widely-known early formulation quickly proved to have limited applicability, yet no alternative decision rules are universally accepted. Cost–benefit analysis is often used as a surrogate for efficiency, but has been widely criticized for incompleteness (Ackerman and Heinzerling 2004). As a result, there will often be competing views of the efficiency outcome for any given policy. Still, the concept is useful for thinking through a policy's long-term economic and social impacts (Young 2005; Weimer and Vining 1999, 331-378).

Efficient outcomes may have differential effects: there are often winners and losers. So assessments of efficiency must consider equity. Here, too, there is no simple answer. Society may be divided into many different deserving sub-groups. Justice can be interpreted using a variety of criteria. Still, we recognize that natural resource policies have to accommodate differences in wealth and income, geographic distribution, race, ethnicity, and gender, while simultaneously recognizing the legitimate interests of rival water user communities (Sager 2002; Mueller 1976).

Both efficiency and equity face the difficult tradeoff between stability and adaptability. Stability allows full exploitation of the potential gains made possible by existing institutions. To the extent that first-order collective action problems can be reasonably resolved, stability allows for the discovery of efficient investments and behaviors. This stability is particularly important for large-scale, long-term investments. Adaptability, on the other hand, sacrifices some of the localized efficiency of stable first-order institutions in order to encourage exploration of greater global efficiencies. Policy tools and institutional changes intended to enhance adaptability need to be judged in terms of the costs to short-term efficiency as well as the potential long-term gains. For example, local consensus-based negotiations may improve scientific and public learning, but may also impose considerable costs due to the extended uncertainties imposed by lengthy negotiations. These costs are probably worthwhile for resolving second-order conflicts that by definition create the potential for greater global efficiencies. But the costs may be less justifiable for resolving the chronic conflicts about the distribution of benefits within first-order institutions when second-order conflicts are rather minor.

Finally, we have come to expect that environmental policy will be sustainable, that the resource uses agreed upon will remain viable beyond the foreseeable future. The origins of sustainability can be found in early twentieth century notions of conservation and sustained yield, but in the years since the 1987 Bruntland Commission report (World Commission 1987), traditional stewardship of natural resources has been extended to recognize the need for socially stable outcomes (Krizek and Power 1996; Caulfield 1978).

Conclusions

In sum, we believe that the five challenges are key to creating successful second-order institutions capable of adaptive governance. Effective representation requires innovative means of ensuring legitimate, meaningful involvement of affected groups in a manner congruent with the norms of representation in the overall political system. Deliberative process design requires a decision process capable of recognizing and articulating the needs of affected users and consolidating them into practical policies that can achieve consensus. Scientific learning requires incorporation of diverse scientific viewpoints to answer critical policy questions, monitor outcomes, and challenge policy assumptions inconsistent with new findings. Public learning requires transformation of beliefs and preferences about legitimate water rights and decision processes among users as well as the community and political institutions. Finally, problem responsiveness requires that the process produces an efficient, equitable, and sustainable solution.

The case studies and analyses in this volume draw preliminary lessons about the institutional characteristics of adaptive governance. We do not attempt to determine the "ideal" solutions for adaptive governance of water resources, particularly since characteristics that help to meet one challenge may exacerbate another. Adaptive water governance above all else requires attention to the specifics of any conflict. Our goal is the more modest one of contributing to the ongoing debate a better understanding of the tradeoffs involved in different institutional designs and their ability to tackle the challenges of effective representation, deliberative process design, scientific and public learning, and problem responsiveness.

Case Study Locations

Water Management Districts
NWFWMD: Northwest Florida Water Management District
SFWMD: South Florida Water Management District
SJRWMD: St. Johns River Water Management District
SRWMD: Suwannee River Water Management District
SWFWMD: Southwest Florida Water Management District

Notes:
* Aquifer Storage and Recovery involves locations throughout the state