Parting Thoughts from the *Sea Grant Law and Policy Journal*'s 2010 Symposium on Adaptive Management

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Abstract: The third annual Sea Grant Law and Policy Journal *symposium was held at the University of Mississippi School of Law in Oxford, Mississippi on March 30 - 31, 2010. During the two-day event, legal scholars, practitioners, and scientific experts explored the challenges associated with implementing adaptive management frameworks for a range of environmental problems in the United States and the United Kingdom. In this article, Terra Bowling, Research Counsel for the National Sea Grant Law Center, provides an overview of the theory of adaptive management and discusses some of the major barriers to implementation in the United States.*

I. Introduction

In 2009, the White House Council on Environmental Quality (CEQ), the Office of Science and Technology Policy (OSTP), and the National Oceanic and Atmospheric Administration (NOAA) formed the Interagency Climate Change Adaptation Task Force to develop U.S. strategy for adaptation to climate change.[2] In October 2009, President Obama signed the Executive Order on Federal Leadership in Environmental, Energy, and Economic Performance, which called for the Task Force to develop, within one year, Federal recommendations for adapting to climate change impacts both domestically and internationally.[3]

As evident in the formation of the Task Force and the ensuing executive order, an adaptive approach to natural resource management is frequently cited as the key to solving complicated environmental problems like climate change. More flexible than a traditional regulatory approach, adaptive management "calls for more experimentalism in regulatory implementation."[4] More specifically, "[u]nder adaptive management, regulators use models of natural resource systems to develop performance measurements and initial policy

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[2] White House Council on Environmental Quality, Climate Change Adaptation Task Force, http://www.whitehouse.gov/administration/eop/ceq/initiatives/adaptation (last visited July 28, 2010).

[3] Exec. Order No. 13,514, 74 Fed. Reg. 52,117 (Oct. 8, 2009).

[4] J.B. Ruhl, *Symposium: Reforming Environmental Law: Can Regulation Be More Adaptive?: Taking Adaptive Management Seriously: A Case Study of the Endangered Species Act*, 52 KAN. L. REV. 1249, 1249 (2004).

choices, but they build into the regulatory implementation framework a process for continuous monitoring, evaluation, and adjustment of decisions and practices."[5] Essentially, adaptive management allows natural resource decision-makers to adjust management regimes to reflect the changing scientific understanding of environmental problems. In his keynote address at the National Sea Grant Law Center's *Sea Grant Law and Policy Journal* 2010 Symposium entitled "Addressing Uncertainty of Environmental Problems: The Challenges of Adaptive Management," Alejandro Camacho suggested that an adaptive governance framework for climate change would promote agency learning and accountability, help manage uncertainty, and reduce the likelihood and magnitude of mistakes expected to come with facing such an exceptional problem with initially imprecise tools.[6]

Despite the expected benefits of an adaptive management approach, a number of significant legal and administrative barriers may hinder the effective implementation of adaptive management regimes. For example, regulatory fragmentation inhibits the implementation of adaptive management regimes, as one resource may be regulated among many local, state, national, and international authorities.[7] And perhaps most daunting, adaptive management regimes face institutional constraints as well as opposition from those who fear a change in the "front-end" approach to managing natural resources.[8] This paper will give an overview of adaptive management, including a look at adaptive management in practice and barriers to implementation.

II. Adaptive Management Theory

The concept of adaptive management may be traced to the works of C.S. Holling and Carl Walters in 1978 and 1986, respectively.[9] Holling was among the first to suggest integrating the concept of resilience into policy, rather than relying on environmental assessment.[10] Walters "described adaptive management as a way to deal with scientific uncertainty when managing renewable resources…"[11]

Traditional environmental law identifies environmental stressors and relies on prescriptive regulation to protect natural resources.[12] For example, regulations might target emissions from smokestacks to protect air quality. However, problems without easily identifiable sources, such as the effects on waterbodies from fertilizer runoff from thousands of miles away, may be too complex for the prescriptive regulation model.[13] "The need for an adaptive

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[5] *Id.* at 1249-50.

[6] For more information on Alejandro Camacho's research in this area, *see* Alejandro E. Camacho, *Adapting Governance to Climate Change: Managing Uncertainty through a Learning Infrastructure*, 59 EMORY L.J. 1 (2009).

[7] *Id.* at 5.

[8] J.B. Ruhl, *It's Time to Learn to Live With Adaptive Management (Because We Don't Have a Choice)*, 39 ENVTL. L. REP. 10920, 10920 (2009).

[9] Mary Jane Angelo, *Resilience and Environmental Law Reform Symposium: Stumbling Toward Success: A Story of Adaptive Law and Ecological Resilience*, 87 NEB. L. REV. 950, 953 (2009).

[10] *Id.*

[11] *Id.*

[12] J.B. Ruhl, *Regulation by Adaptive Management—Is it Possible?* 7 MINN. J.L. SCI. & TECH. 21, 21 (2005-2006).

[13] *Id.* at 25.

approach to management became apparent in light of new understanding of ecosystems as dynamic, rather than as having only one equilibrium state. Since then, government agencies have been trying to account for the disparity between science and environmental law and formulate a system that can adjust to confront scientific uncertainty."[14]

Many government agencies have sought to define and integrate an adaptive management approach. For example, adaptation is defined by the Intergovernmental Panel on Climate Change as "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities."[15] The Adaptive Management Technical Guidance from the U.S. Department of the Interior defines adaptive management as "a decision process that promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process … It is not a 'trial and error' process, but rather emphasizes learning while doing."[16] The National Research Council branch of the National Academy of Sciences identified eight steps for implementing adaptive management: (1) definition of the problem; (2) determination of goals and objectives for management of ecosystems; (3) determination of the ecosystem baseline; (4) development of conceptual models; (5) selection of future restoration actions; (6) implementation and management actions; (7) monitoring and ecosystem response; and (8) evaluation of restoration efforts and proposals for remedial actions.[17]

Camacho suggests that an adaptive governance framework that requires agencies to systematically monitor and adapt their decisions and programs, as well as interagency information sharing, will help with complex environmental problems like climate change.[18] He suggests that this learning infrastructure would promote agency learning and accountability, help manage uncertainty, and reduce the likelihood and magnitude of mistakes expected to come with facing such an exceptional problem with initially imprecise tools.

III. Adaptive Management In Practice

While many federal agency regulations and policies call for adaptive management, scholars have noted that regulatory guidance on how to implement the theory is scarce.[19] "The theory of adaptive management—what is meant by the words—is quite well established. It

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[14] Angelo, *supra* note 9.

[15] INTERAGENCY CLIMATE CHANGE ADAPTATION TASK FORCE, PROGRESS REPORT 1 (Mar. 16, 2010), *available at* http://www.whitehouse.gov/sites/default/files/microsites/ceq/20100315-interagency-adaptation-progress-report.pdf .

[16] U.S. DEP'T OF THE INTERIOR, ADAPTIVE MANAGEMENT TECHNICAL GUIDE 4 (2009), *available at* http://www.doi.gov/initiatives/AdaptiveManagement/TechGuide.pdf .

[17] Ruhl, *supra* note 8, at 10920-21 (citing COMM. ON ENDANGERED AND THREATENED FISHES IN THE KLAMATH RIVER BASIN, BD. ON ENVTL. STUDIES AND TOXICOLOGY, DIV. ON EARTH & LIFE STUDIES, NATIONAL RESEARCH COUNCIL, ENDANGERED AND THREATENED FISHES IN THE KLAMATH RIVER BASIN: CAUSES OF DECLINE AND STRATEGIES FOR RECOVERY (2004)).

[18] Camacho, *supra* note 6, at 1.

[19] *Id.*

is the practice of adaptive management—what to do to make those words come true—that has been far more elusive to get on the page."[20] Another academic noted that "Unfortunately, although numerous examples exist where resource agencies adopted adaptive management policies, at least in name, as part of a variety of environmental management and/or restoration projects, examples of successful adaptive management are hard to find."[21]

One of the first instances of adaptive management implementation in resource management is the Columbia River Basin Fish and Wildlife Program. Hydropower development in the river basin had resulted in damage to the region's fish and wildlife. After several Snake River salmon populations were listed as endangered, Congress passed the Pacific Northwest Electric Power Planning and Conservation Act in 1980.[22] The Act established the Pacific Northwest Electric Power and Conservation Planning Council, which required the council to develop a program to protect fish and wildlife while treating the river and its tributaries as a "system." The Council adopted an adaptive management policy in its action plan, noting that adaptive management "recognizes biological uncertainty, while accepting the congressional mandate to proceed on the basis of the 'best available scientific knowledge.'"[23]

Following the Columbia River Basin program, several federal and state agencies have adopted adaptive management methods. At the Symposium, Lance Gunderson of the Department of Environmental Studies at Emory University presented "Scientific Underpinnings of Adaptive Management and Adaptive Governance."[24] In his presentation, Gunderson used the examples of adaptive management approaches in two ecosystems, the Colorado River in the Grand Canyon and the Florida Everglades. He explained that adaptive forms of experimentation and governance are needed in these large complex ecosystems to resolve chronic resource issues and achieve restoration goals.

The Department of the Interior created the Glen Canyon Adaptive Management Program after an Environmental Impact Statement in 1995 recommended adaptive management as a way to mitigate environmental impacts and comply with federal law.[25] The Dam had altered the flow of the river, which resulted in decreased sediment deposits that build canyon beaches, decreased river temperature, and fluctuating releases of water which threatened indigenous fish, some of which were listed as endangered species.[26] The Plan employs an advisory committee review panel, as well as the Technical Working Group, the Grand Canyon Monitoring and Research Center, and Independent Review Panels.[27] The

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[20] *Id.*
[21] Angelo, *supra* note 9.
[22] 16 U.S.C. §§ 839-839h.
[23] Angelo, *supra* note 9 (citing Kai N. Lee & Jody Lawrence, *Adaptive Management: Learning from the Columbia River Basin Fish and Wildlife Program*, 16 ENVTL. L. 431, 440-41 (1986)).
[24] A video of Lance Gunderson's presentation and his PowerPoint slides can be accessed at http://nsglc.olemiss.edu/SGLPJ/symposium10.htm .
[25] BUREAU OF RECLAMATION, U.S. DEP'T OF THE INTERIOR, FINAL ENVTL. IMPACT STATEMENT FOR OPERATION OF GLEN CANYON DAM, COLO. RIVER STORAGE PROJECT, ARIZ. 34-38 (1995).
[26] Angelo, *supra* note 9, at 956-57.
[27] Lawrence Susskind, et al., *Collaborative Planning and Adaptive Management in Glen Canyon: A Cautionary Tale*, 35 COLUM. J. ENVTL. L. 1, 4 (2010).

adaptive management approach has allowed the agencies to experiment with flow regimes and comply with the National Environmental Policy Act's Environmental Impact Statement requirement.[28] For the most part, the Glen Canyon Program has been considered a success.

> Glen Canyon Dam offers an ideal opportunity for the systematic application of collaborative adaptive management, especially since scientific uncertainty and disagreements have been central to the ongoing acrimony among stakeholders. If implemented effectively, [collaborative adaptive management (CAM)] can lead to more sustainable management of natural resources and increase public support for whatever tradeoffs have to be made among ecological, economic development, and social welfare objectives. By bringing all parties to the table, more information—including a clearer presentation of the risks associated with managing the area's resources—can be obtained. When trust is fostered, parties are more open to searching for ways of meeting the interests of others rather than simply fighting for their personal interests. CAM can encourage careful review of how previous management efforts have and have not worked.[29]

Efforts at adaptive management in the Florida Everglades have been less successful.[30] In 1988, several scientists, including Gunderson, helped run a series of adaptive environmental assessment workshops in which they determined that restoration of the Florida Everglades was possible, despite significant degradation.[31] Federal and state governments have attempted to build on these efforts. In 1996, Congress authorized the South Florida Ecosystem Restoration Task Force and directed the Corps of Engineers to develop "a proposed comprehensive plan for the purpose of restoring, preserving, and protecting the South Florida ecosystem."[32] The Corps recommended the Comprehensive Everglades Restoration Plan (CERP) to fight, among other problems, wetlands loss and declining populations of species. Congress adopted the plan in the Water Resources Development Act of 2000.[33]

Despite these efforts, "implementation of restoration projects has been exceedingly slow."[34] While the CERP contains adaptive management principles, "the jury is still out on restoration accomplishments."[35] According to Zellmer and Gunderson, there are two primary criticisms: "the CERP devotes too much attention to the use of ever more heroic engineering techniques to expand water supplies and ensure flood control for South Florida's exploding population" and too much emphasis is placed on maintaining

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[28] Angelo, *supra* note 9, at 956-957.
[29] Susskind, *supra* note 27, at 5-6.
[30] *See*, Sandi Zellmer and Lance Gunderson, *Why Resilience May Not Always Be a Good Thing: Lessons in Ecosystem Restoration from Glen Canyon and the Everglades*, 87 NEB. L. REV. 893 (2009); Lance H. Gunderson and Stephen S. Light, *Adaptive Management and Adaptive Governance in the Everglades*, POLICY SCIENCES 39(4): 323-334 (2006).
[31] Zellmer and Gunderson, *supra* note 30, at 917.
[32] *Id.* at 917-18.
[33] Water Resources Development Act of 2000, Pub. L. No. 106-541, § 601, 114 Stat. 2572, 2680 (Dec. 11, 2000).
[34] Zellmer, *supra* note 30, at 918.
[35] *Id.* at 921.

stakeholders' economic interests, "which place a chokehold on experimentation, learning, and adaptation."[36]

IV. Barriers to Implementation

Why are agencies hesitant to put the theory of active adaptive management into practice? "It is because as a practical matter they are not truly expected or allowed to."[37] Governments "continue to command agencies to practice adaptive management, yet keep the agencies' hands tied in the ropes of conventional administrative process."[38] J.B. Ruhl stated that, "The problem is that adaptive management is not just an option anymore; it has become a necessity."[39]

Some legal scholars have questioned its necessity. Oliver Houck argued that adaptive management is not a solution for all environmental problems, "The most obvious place it does not belong is with planning for large public works and resource extraction projects that have identifiable environmental impacts that need to be assessed as fully as possible up-front, in order to make rational choices among modes, locations, and alternatives… On the other hand, where government action proposes a more experimental target such as restoring an ecosystem, or a species, there is a legitimate case for flexibility in getting there."[40]

Despite the debate over the need for adaptive management, its implementation does face very real barriers. First, there is the barrier of overcoming a "business as usual" approach. According to J.B. Ruhl, some of the criticisms of adaptive management include arguments that:

- Agencies will defer the "tough" decisions for later in promises of adaptive management, but then never make them.
- Agencies will truncate public participation and ignore public input.
- Agencies will enjoy and exercise unbounded discretion beyond the reach of judicial review.
- Agencies will collaborate in loose networks so as to hide accountability.
- Agencies will parse decisions into smaller units, making it difficult to identify which decision to challenge in court.
- Agencies will not rely on sound science and robust data.
- Agencies will operate as central planning science elites.[41]

Ruhl notes that these are legitimate concerns, but they are not new and traditional regulatory models are not working. He also cites political maneuvering as a source of the criticisms.

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[36] *Id.*
[37] Ruhl, *supra* note 8, at 10921.
[38] *Id.*
[39] *Id.*
[40] Oliver A. Houck, *Nature or Nurture: What's Wrong and What's Right With Adaptive Management*, 39 ENVTL. L. REP. 10923 (2009).
[41] Ruhl, *supra* note 8, at 10921.

As Gunderson noted, "The highly political nature of many regulatory decisions can be a significant impediment to adaptive measures."[42] As a result, "decision-makers can be reluctant to experiment and take advantage of feedback loops for fear of resistance from vested interests."[43]

Regulatory fragmentation presents another barrier. For example, Alejandro Camacho argued that existing fragmented governance is poorly equipped to deal with the challenges of adapting to the effects of climate change. "In such a splintered regulatory setting, private demands for government action are split among various potential regulators. Regulators who act early are likely to receive diluted credit as other regulators free ride on their efforts while status quo biases and risk aversion create additional incentives for regulatory inaction. Regulators thus have little incentive to devote resources to gather information on—or regulate the risks of—global climate change."[44] Other regulators have cited limited jurisdiction as a reason to ignore climate change.[45]

As Zellmer and Gunderson noted, adaptive management may be hindered by legal obstacles posed by federal laws, such as the Endangered Species Act, which requires consultation for all discretionary federal actions that may adversely affect a listed species or its critical habitat. "Adaptive management requires sufficient flexibility in applicable management mandates and sufficient resilience in ecological resources in order to experiment. Endangered or threatened taxa do not have such resilience and so it is difficult to conduct experiments in which the outcome can just as easily cause further endangerment as it can result in recovery."[46]

At the Symposium, Andrew Long, Assistant Professor of Law at Florida Coastal School of Law, cited the Columbia River Basin Fish and Wildlife Program "as a cautionary tale of the limits of adaptive management."[47] He stated that institutional constraints have proven nearly insurmountable obstacles to the experimentation and monitoring necessary to fully implement the adaptive management approach. Long argued that instead of focusing on the management of the fishery, attempts at adaptive management have resulted in continual efforts to build public support and stakeholder agreement. Gunderson noted similar issues with implementing adaptive management in the Everglades.

V. Conclusion

What will successful adaptive management look like? According to Ruhl, "It will be a structure in which interest groups participate rather than maneuver for litigation, in which

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[42] Zellmer and Gunderson, *supra* note 30, at 946.
[43] *Id.* at 946-47.
[44] Susskind, *supra* note 27, at 28.
[45] *Id.* (citing U.S. GOV'T ACCOUNTABILITY OFFICE, CLIMATE CHANGE, AGENCIES SHOULD DEVELOP GUIDANCE FOR ADDRESSING THE EFFECTS ON FEDERAL LAND AND WATER RESOURCES at 156, 159, 163, 167 (2007) (conveying comments by various officials regarding their agencies' limited capacity to respond to climate change)).
[46] Zellmer, *supra* note 31, at 947.
[47] Andrew Long, *Adaptive Management of Salmon in the Columbia River Basin*, presentation given at the *Sea Grant Law and Policy Journal* Symposium: Addressing Uncertainty of Environmental Problems: The Challenges of Adaptive Management, March 31, 2010, Oxford, MS, *available at* http://nsglc.olemiss.edu/SGLPJ/symposium10.htm .

agencies can make mistakes and not be crucified, and in which courts act as referees not police."[48]

On March 16, 2010, the Task Force released an Interim Report on its progress and recommended six key components to include in a national strategy on climate change adaptation: (1) Integration of Science into Adaptation Decisions and Policy; (2) Communications and Capacity-building; (3) Coordination and Collaboration; (4) Prioritization; (5) A Flexible Framework for Agencies; and (6) Evaluation. Now, the test is to put the definition into action. As mentioned above, adaptive management faces many barriers, but a "continuing commitment to adaptive management is critical in achieving restoration success."[49]

[48] Ruhl, *supra* note 8, at 10922.
[49] Zellmer, *supra* note 30, at 928.