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Article

Adaptive Management in the Courts

J.B. Ruhl[†] and Robert L. Fischman^{††}

INTRODUCTION

Adaptive management has become the tonic of natural resources policy. With its core idea of “learning while doing,”¹ adaptive management has breathed life and hope into a policy realm beset by controversy, uncertainty, and complexity. It offers what many believe is needed most in a world bombarded by ecological deterioration of massive scales—expert agencies exercising professional judgment through an iterative decisionmaking process emphasizing definition of goals, description of policy decision models, active experimentation with monitoring of conditions, and adjustment of implementation decisions as suggested by performance results. This ideal has become infused into the natural resources policy world to the point of ubiquity, surfacing in everything from mundane agency per-

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1. Professor Holly Doremus explains:

[A]ctive learning is rarely incorporated into the resource management process. For iterative or related decisions, where there is no “safe” choice, precaution and science are not in tension. Both point us toward an incremental framework for decision making that emphasizes learning. We might call that framework adaptive management, but . . . I prefer the more descriptive phrase “learning while doing.”

Holly Doremus, *Precaution, Science, and Learning While Doing in Natural Resource Management*, 82 WASH. L. REV. 547, 550 (2007). For more detail on what “learning while doing” entails, see *infra* Part I.

mits² to grand presidential proclamations.³ Indeed, it is no exaggeration to suggest that these days adaptive management *is* natural resources policy.

But is it working? Does appending “adaptive” in front of “management” somehow make natural resources policy, which has always been about balancing competing claims to nature’s bounty, something more and better? Many legal and policy scholars have asked that question, with mixed reviews.⁴ Their

2. For example, the U.S. Fish and Wildlife Service (FWS) has proclaimed it will use adaptive management in administering habitat conservation plan (HCP) permits it issues pursuant to the Endangered Species Act (ESA). This will be done as a means to “examine alternative strategies for meeting measurable biological goals and objectives through research and/or monitoring, and then, if necessary, to adjust future conservation management actions according to what is learned.” Final Handbook for Habitat Conservation Planning and Incidental Take Permitting Process, 64 Fed. Reg. 11,485, 11,486 (Mar. 9, 1999). As one FWS official explained:

We will continue to incorporate contingency planning within all types of HCPs. In the future, HCPs will have improved structure in their adaptive management strategies Increased structure in adaptive management strategies will require increased vigilance on the part of permittees and the Service during implementation of long-term plans; this reflects the nature of the conservation partnership created by HCPs.

Marj Nelson, *The Changing Face of HCPs*, 25 ENDANGERED SPECIES BULL. 4, 7 (2000).

3. See, e.g., Exec. Order No. 13,508, 74 Fed. Reg. 23,099, 23,101–03 (May 12, 2009) (directing the EPA to draft pollution-control strategies for the Chesapeake Bay watershed that are “based on sound science and reflect adaptive management principles,” while also directing the Departments of the Interior and Commerce to use “adaptive management to plan, monitor, evaluate, and adjust environmental management actions” in the Chesapeake Bay watershed).

4. See Mary Jane Angelo, *Stumbling Toward Success: A Story of Adaptive Law and Ecological Resilience*, 87 NEB. L. REV. 950, 951–52 (2009) (detailing the theory of adaptive management through a case study based in Florida); Alejandro Esteban Camacho, *Can Regulation Evolve? Lessons from a Study in Maladaptive Management*, 55 UCLA L. REV. 293, 294–99 (2007) (critiquing the use of adaptive management in the ESA); Holly Doremus, *Adaptive Management, the Endangered Species Act, and the Institutional Challenges of “New Age” Environmental Protection*, 41 WASHBURN L.J. 50, 50–52 (2001) (identifying challenges for adaptive management in the administration of the ESA); Robert L. Glicksman, *Ecosystem Resilience to Disruptions Linked to Global Climate Change: An Adaptive Approach to Federal Land Management*, 87 NEB. L. REV. 833, 871 (2009) (proposing the broad use of adaptive management in public land management); Bradley C. Karkkainen, *Panarchy and Adaptive Change: Around the Loop and Back Again*, 7 MINN. J. L. SCI. & TECH. 59, 70–71 (2005) (examining the theory of active adaptive management); J.B. Ruhl, *Regulation by Adaptive Management—Is It Possible?*, 7 MINN. J. L. SCI. & TECH. 21, 33–34 (2005) (identifying disconnects between adaptive management and conventional administrative procedure); Annecoos Wiersema, *A Train Without Tracks: Rethinking the Place of Law and Goals in Environmental and Natural Resources Law*, 38 ENVTL. L. 1239, 1239 (2008)

evaluations, however, have rested on theory,⁵ program-specific surveys,⁶ and focused case studies.⁷ No study has comprehensively explored and extracted lessons from what likely matters significantly to the natural resource agencies practicing adaptive management—how is it faring in the courts? We do so in this Article.

Part I of this Article examines the theory, policy, and practice of adaptive management, focusing on the experience of the federal resource management agencies. From theory to policy to practice, at each step forward in the emergence of adaptive management something has been lost in the translation. The end product is something we call “a/m-lite,”⁸ a watered-down version of the theory that resembles ad hoc contingency planning more than it does planned “learning while doing.” This gap between theory and practice leads to profound disparities between how agencies justify decisions and how adaptive management in practice arrives at the courthouse doorsteps.

(arguing that adaptive management by agencies pays insufficient attention to substantive goals).

5. See, e.g., Karkkainen, *supra* note 4, at 69–74 (examining the theories of passive and active adaptive management).

6. The use of adaptive management to implement ESA programs has received considerable attention. See, e.g., Camacho, *supra* note 4, at 293; Doremus, *supra* note 4, at 50–52; J.B. Ruhl, *Taking Adaptive Management Seriously: A Case Study of the Endangered Species Act*, 52 KAN. L. REV. 1249, 1250–51 (2004).

7. See, e.g., Angelo, *supra* note 4, at 966–90 (Lake Apopka in Florida); Melinda Harm Benson, *Adaptive Management by Resource Management Agencies in the United States: Implications for Energy Development in the Interior West*, 28 J. ENERGY & NAT. RESOURCES L. 87, 92–95 (2010) (Bureau of Land Management energy development on federal public lands in Wyoming); Melinda Harm Benson, *Integrating Adaptive Management and Oil and Gas Development: Existing Obstacles and Opportunities for Reform*, 39 ENVTL. L. REP. 10,962, at 10,962 (2009) (oil and gas development in Wyoming); Alejandro Esteban Camacho, *Beyond Conjecture: Learning About Ecosystem Management from the Glen Canyon Dam Experiment*, 8 NEV. L.J. 942, 944–49 (2008) (Glen Canyon Dam adaptive management project); John H. Davidson & Thomas Earl Geu, *The Missouri River and Adaptive Management: Protecting Ecological Function and Legal Process*, 80 NEB. L. REV. 816, 820–33 (2001) (Missouri River); Alfred R. Light, *Tales of the Tamiami Trail: Implementing Adaptive Management in Everglades Restoration*, 22 J. LAND USE & ENVTL. L. 59, 69–89 (2006) (Florida Everglades); Lawrence Susskind et al., *Collaborative Planning and Adaptive Management in Glen Canyon: A Cautionary Tale*, 35 COLUM. J. ENVTL. L. 1, 7–23 (2010) (Glen Canyon Dam adaptive management project).

8. “a/m-lite” is a stripped-down version of adaptive management that often fails due to management, implementation, and planning problems. See *infra* text accompanying notes 69–70.

In Part II, we review how these disparities have played out in courts. We consider claims that agency practice of adaptive management has not lived up to either its theoretical promise or to the legal demands of substantive and procedural law. Our overall assessment is that, although courts genuinely and often enthusiastically endorse adaptive management theoretically, they frequently are underwhelmed by how agencies implement adaptive management in the field. We extract three key themes from the body of case law in this respect: (1) larger-scale plans are more likely to incorporate adaptive management plans that withstand judicial scrutiny than are smaller-scale ones; (2) the practice of tiering site-specific environmental impact analyses to an earlier, overarching, cumulative study is well suited to adaptive management, and adaptive management can reduce the need for supplemental analyses; and (3) adaptive management procedures, no matter how finely crafted, cannot substitute for showing that a plan will meet substantive management criteria required by law.

The pool of judicial opinions on adaptive management is still limited in scope, leaving many questions unanswered and providing only a partial playbook for how agencies should move forward. In Part III, therefore, we extend from the existing case law to draw lessons for both Congress and agencies about the future practice of adaptive management. The message for Congress is straightforward—provide more funding and clearer standards. With neither option likely in the foreseeable future, agencies cannot as a practical matter hope to practice a fully realized version of adaptive management theory. Our message to agencies, however, is that even compromised adaptive management, in the form of a/m-lite, can be an effective decision method—and one that survives judicial scrutiny. But, in order for that to be the case, agencies must be more disciplined about its design and implementation. This includes resisting the temptation to employ adaptive management to dodge burdensome procedural requirements, committing to substantive management criteria, and engaging contentious stakeholder participation.

I. THE THEORY, POLICY, AND PRACTICE OF ADAPTIVE MANAGEMENT

Adaptive management has moved amazingly fast from theoretical drawing board to policy marketing plan to practice production line. Along the way, however, it has been watered

down to a weak lemonade of ad hoc contingency planning. Adaptive management as practiced by the federal resource management agencies just does not seem to have quite the same refreshing appeal as adaptive management in theory. In this Part of the Article, we explore this gap and identify the tensions it poses for adaptive management in the courts.⁹

A. THEORY

Over the past two decades, natural resources policy has gravitated to a model of nested, ever-changing, complex ecosystems, the essence of which demands a management policy framework every bit as dynamic as the ecosystems it seeks to manage.¹⁰ This rapidly solidifying framework, known as ecosystem management, focuses on natural resources as ecologically functioning landscape units rather than as disassembled parts—the trees, the water, the grassland, the species, and so on.¹¹ To achieve this goal, ecosystem management intends to move decisionmaking from a process of setting rigid standards based on comprehensive rational planning to one of experimentation using continuous monitoring, assessment, and recalibration. The dominant of these new decision methods emerged in

9. This Part builds on themes developed in J.B. Ruhl, *Adaptive Management for Natural Resources—Inevitable, Impossible, or Both?*, 54 ROCKY MTN. MIN. L. INST. 11-1, 11-2 (2008).

10. The development of natural resources law has taken many of its cues from environmental and ecological sciences, which themselves have evolved over time. See Fred P. Bosselman & A. Dan Tarlock, *The Influence of Ecological Science on American Law: An Introduction*, 69 CHI.-KENT L. REV. 847, 847–54 (1994). With ecology in particular, the trend over the past half-century has been increasingly to focus on the complex flux qualities of ecosystems and to place less emphasis on conceptions of stasis and natural stability. See Reed F. Noss, *Some Principles of Conservation Biology, as They Apply to Environmental Law*, 69 CHI.-KENT L. REV. 893, 893 (1994) (“Among the new paradigms in ecology, none is more revolutionary than the idea that nature is not delicately balanced in equilibrium, but rather is dynamic, often unpredictable, and perhaps even chaotic.”); see also Bryan Norton, *Change, Constancy, and Creativity: The New Ecology and Some Old Problems*, 7 DUKE ENVTL. L. & POLY F. 49, 49 (1996); Jonathan Baert Wiener, *Law and the New Ecology: Evolution, Categories, and Consequences*, 22 ECOLOGY L.Q. 325, 326–27 (1995).

11. For the seminal works developing ecosystem management theory and policy, see Norman L. Christensen et al., *The Report of the Ecological Society of America on the Scientific Basis for Ecosystem Management*, 6 ECOLOGICAL APPLICATIONS 665, 665–66 (1996), and R. Edward Grumbine, *What Is Ecosystem Management?*, 8 CONSERVATION BIOLOGY 27, 27 (1994). The legal contours of ecosystem management are comprehensively explored in JOHN COPELAND NAGLE & J.B. RUHL, *THE LAW OF BIODIVERSITY AND ECOSYSTEM MANAGEMENT* (2d ed. 2006).

the theory of adaptive management C.S. “Buzz” Holling and his co-authors laid out in the influential book from the late 1970s, *Adaptive Environmental Assessment and Management*.¹²

Holling and his fellow researchers found conventional environmental management methods, particularly the environmental impact analysis process that lies at the core of the National Environmental Policy Act (NEPA),¹³ at odds with the emerging model of ecosystem dynamics. They focused on the basic properties of ecological systems to provide the premises of a new assessment and management method.¹⁴ Under a dynamic model of ecosystems, they concluded, management policy must put a premium on collecting information, establishing measurements of success, monitoring outcomes, using new information to adjust existing approaches, and a willingness to change.¹⁵ The traditional management approach of natural resources policy was “to attack environmental stressors in piecemeal fashion, one at a time,” and to parcel decisionmaking “out among a variety of mission-specific agencies and resource-specific management regimes.”¹⁶ In contrast, the adaptive management framework is more evolutionary and interdisciplinary, relying on iterative cycles of goal determination, model building, performance standard setting, outcome monitoring, and standard recalibration. Indeed, advanced versions of adaptive management incorporate an experimentalist research element, in which management actions deliberately probe for information to evaluate testable hypotheses about the effects of active intervention in ecological processes, such as evaluating the effects a chosen habitat management action and its alternatives might have on invasive species by running small-scale test plot experiments.¹⁷

Adaptive management has evolved well beyond an idea. Indeed, from the earliest emergence of ecosystem management

12. C.S. HOLLING ET AL., *ADAPTIVE ENVIRONMENTAL ASSESSMENT AND MANAGEMENT* (C.S. Holling ed., 1978); Kai N. Lee & Jody Lawrence, *Restoration Under the Northwest Power Act: Adaptive Management: Learning from the Columbia River Basin Fish and Wildlife Program*, 16 ENVTL. L. 431, 442 n.45 (1986) (tracing the term “adaptive management” to Holling’s book).

13. NEPA is explored in more detail *supra* Part III.

14. HOLLING ET AL., *supra* note 12, at 25–37.

15. *Id.* at 1–21.

16. Bradley C. Karkkainen, *Bottlenecks and Baselines: Tackling Information Deficits in Environmental Regulation*, 86 TEX. L. REV. 1409, 1439 (2008).

17. See CARL WALTERS, *ADAPTIVE MANAGEMENT OF RENEWABLE RESOURCES* 232 (1986); Karkkainen, *supra* note 4, at 70–71.

policy, there has been broad consensus among resource managers and academics that adaptive management is the only practical way to implement ecosystem management.¹⁸ Recently, for example, the National Research Council branch of the National Academy of Sciences convened a committee of scientists to explore how adaptive management might be used to improve resource agency decisionmaking for ecosystem management in the Klamath River Basin, which straddles southern Oregon and northern California.¹⁹ The basin had been beset for decades with water management conflicts pitting farming, fishing, tribal, recreational, and species interests in constant battle.²⁰ Noting there had been “little effort to implement adaptive-management strategies in the Klamath basin,”²¹ the committee synthesized the theoretical formulations to date to outline eight key steps of 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.²² The committee’s description of the last stage provides some flavor of how adaptive management differs from conventional natural resources management in the way Holling and his fellow researchers deemed most important:

After implementation of specific restoration activities and procedures, the status of the ecosystem is regularly and systematically reassessed and described. Comparison of the new state with the baseline state is a measure of progress toward objectives. The evaluation process feeds directly into adaptive management by informing the implementation

18. See Ronald D. Brunner & Tim W. Clark, *A Practice-Based Approach to Ecosystem Management*, 11 CONSERVATION BIOLOGY 48, 56 (1997); Anne E. Heissenbuttel, *Ecosystem Management—Principles for Practical Application*, 6 ECOLOGICAL APPLICATIONS 730, 732 (1996); Paul L. Ringold et al., *Adaptive Management Design for Ecosystem Management*, 6 ECOLOGICAL APPLICATIONS 745, 745–46 (1996). Indeed, the Ecological Society of America’s comprehensive study of ecosystem management treats the use of adaptive management methods as a given. See Christensen et al., *supra* note 11, at 670.

19. See COMM. ON ENDANGERED & THREATENED FISHES IN THE KLAMATH RIVER BASIN, ENDANGERED AND THREATENED FISHES IN THE KLAMATH RIVER BASIN: CAUSES OF DECLINE AND STRATEGIES FOR RECOVERY 1–3 (2004). In the interests of full disclosure, Professor Ruhl served on the so-called Klamath Committee.

20. See *id.* at 17–45.

21. *Id.* at 335.

22. See *id.* at 332–35.

team and leading to testing of management hypotheses, new simulations, and proposals for adjustments in management experiments or development of wholly new experiments or management strategies.²³

By contrast, the committee observed that “[e]cosystem management in the Klamath basin typically has pursued the widely recognized alternatives to adaptive management: deferred action and trial and error involving crisis management.”²⁴ These approaches magnify losses to resources, undervalue information, and overvalue action for action’s sake.²⁵ While an adaptive management approach would need to adhere to legal constraints of the Endangered Species Act (ESA) and established water rights, the committee identified a number of management innovations that could take pressure off the water management conflicts, such as water banks and reoriented agency management structures and processes.²⁶

B. POLICY

Federal resource management agencies have had difficulty translating the theoretical descriptions of adaptive management into policy. Rather than elaborating on the theoretical framework by providing details for implementation of the eight steps of adaptive management, agencies adopting adaptive management have gone in the reverse direction, condensing the policy of adaptive management into the bumper-sticker sized slogan of “learning while doing.”²⁷

For example, one of the first movers on adaptive management, the U.S. Fish and Wildlife Service (FWS), has employed this definition of adaptive management in its policy guidance for the ESA permit program since 2000:

Adaptive management is an integrated method for addressing uncertainty in natural resource management. It also refers to a structured process for learning by doing Passive adaptation is where information obtained is used to determine a single best course of action. Active adaptation is developing and testing a range of alternative strategies. The Services believe that both of these types of adaptive management are appropriate to consider when developing a strategy to address uncertainty. Therefore, we are defining adaptive manage-

23. *Id.* at 335.

24. *Id.* at 336.

25. *See id.*

26. *See id.* at 340–43. For a thorough history of the basic controversy in the Klamath basin dispute, including the impact and aftermath of the Committee report, see HOLLY DOREMUS & A. DAN TARLOCK, WATER WAR IN THE KLAMATH BASIN (2008).

27. *See supra* note 1 and accompanying text.

ment broadly as a method for examining alternative strategies for meeting measurable biological goals and objectives, and then, if necessary, adjusting future conservation management actions according to what is learned.²⁸

Similarly, the Department of the Interior (DOI), in its *Adaptive Management Technical Guide*, defines adaptive management using a long-winded version of the “learning while doing” theme adopted from the National Research Council:

Adaptive management [is 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.²⁹

The mantras of “learning while doing” and “learning by doing” may capture the essence of adaptive management, but these phrases hardly convey how to do it. The picture gets no clearer as one moves from policy guidance to formal regulatory definitions. For example, the joint regulation for compensatory wetland mitigation—promulgated in April of 2008 by the U.S. Army Corps of Engineers (Army Corps) and the Environmental Protection Agency (EPA)³⁰—defines adaptive management as

the development of a management strategy that anticipates likely challenges associated with compensatory mitigation projects and provides for the implementation of actions to address those challenges, as well as unforeseen changes to those projects. It requires consideration of the risk, uncertainty, and dynamic nature of compensatory mitigation projects and guides modification of those projects to optimize performance. It includes the selection of appropriate measures that will ensure that the aquatic resource functions are provided and involves analysis of monitoring results to identify potential problems of a compensatory mitigation project and the identification and implementation of measures to rectify those problems.³¹

The U.S. Forest Service’s 2008 rule on national forest planning,³² which drips with references to adaptive management, provides even less definitional detail:

28. Notice of Availability of a Final Addendum to the Handbook for Habitat Conservation Planning and Incidental Take Permitting Process, 65 Fed. Reg. 35,242, 35,252 (June 1, 2000) (internal citations omitted).

29. BYRON K. WILLIAMS ET AL., *ADAPTIVE MANAGEMENT: THE U.S. DEPARTMENT OF INTERIOR TECHNICAL GUIDE*, at v (2009).

30. See *Compensatory Mitigation for Losses of Aquatic Resources*, 73 Fed. Reg. 19,594 (Apr. 10, 2008).

31. 33 C.F.R. § 332.2 (2009).

32. *National Forest System Land Management Planning*, 73 Fed. Reg. 21,468 (Apr. 21, 2008).

Adaptive management: A system of management practices based on clearly identified outcomes and monitoring to determine if management actions are meeting desired outcomes; and, if not, to facilitate management changes that will best ensure that outcomes are met or re-evaluated. Adaptive management stems from the recognition that knowledge about natural resource systems is sometimes uncertain.³³

The point is that these and other legal definitions of adaptive management have done little to pin down what makes natural resources management “adaptive” for purposes of measuring and evaluating agency decisions. Further content is not generally supplied in agency substantive and procedural regulations. For example, section 404 of the new Clean Water Act’s wetland compensatory mitigation program regulations requires applicants to develop adaptive management plans as part of a larger, permitting process and use it to guide decisionmaking over relevant permit time frames.³⁴ Thus, among

33. 36 C.F.R. § 219.16 (2009) (emphasis removed). This rule is currently enjoined by *Citizens for Better Forestry v. U.S. Department of Agriculture*, 632 F. Supp. 2d 968, 980 (N.D. Cal. 2009), and the Forest Service has requested public input on what direction the planning rule should take. See National Forest System Land Management Planning, 74 Fed. Reg. 67,165, 67,166 (Dec. 18, 2009). The Forest Service adopted the same definition in its August 2007 proposed rules updating its procedures for NEPA compliance. See National Environmental Policy Act Procedures, 72 Fed. Reg. 45,998, 46,003 (Aug. 16, 2007). States do little better. California defines adaptive management, in the context of wildlife conservation planning, as “us[ing] the results of new information gathered through the monitoring program of the plan and from other sources to adjust management strategies and practices to assist in providing for the conservation of covered species.” CAL. FISH & GAME CODE § 2805(a) (West 2010). A Minnesota statute implementing the Great Lakes compact defines it as “a water resources management system that provides a systematic process for evaluation, monitoring and learning from the outcomes of operational programs and adjustment of policies, plans and programs based on experience and the evolution of scientific knowledge concerning water resources and water dependent natural resources.” MINN. STAT. § 103G.801(1.2) (2010). Adaptive management in Oregon means “applying management or practices over time and across the landscape to achieve site specific resource goals using an integrated and science based approach that results in changes over time in response to feedback or monitoring.” OR. REV. STAT. § 541.351(1) (2010). In Washington it means simply “reliance on scientific methods to test the results of actions taken so that the management and related policy can be changed promptly and appropriately.” WASH. REV. CODE ANN. § 76.09.020(1) (West 2010).

34. Section 404 of the Clean Water Act, jointly administered by the Army Corps of Engineers (Army Corps) and the EPA, establishes a program to regulate the discharge of dredged or fill material into waters of the United States, including wetlands. Activities in waters of the United States regulated under section 404 include fill for development, water resource projects (such as dams and levees), infrastructure development (such as highways and airports), and mining projects. Section 404 requires a permit before dredged or fill material may be discharged into waters of the United States, unless the activity is exempt from section 404 regulation (e.g., certain farming and forestry activities).

the regulatory requirements for “planning and documentation” in mitigation plans, the rule requires compilation of an “adaptive management plan” to “guide decisions for revising compensatory mitigation plans and implementing measures to address both foreseeable and unforeseen circumstances that adversely affect compensatory mitigation success.”³⁵ With the requirement of adaptive management plans in hand, however, the rule does not go much further in explaining how they are to be designed and implemented, leaving it to the local Army Corps “district engineer, in consultation with the responsible party (and other federal, tribal, state, and local agencies, as appropriate), [to] determine the appropriate measures.”³⁶ The upshot of the rule is that the adaptive management plan will be used when needed, at which time the district engineer and regulated party will figure out how to adapt.

This wait-and-see approach hardly seems what Holling and his adaptive management theory progeny have in mind. Rather than require plans that build in the objectives, hypotheses, models, standards-information flows, and transparency of adaptive management, these rules leave the actual content of plans undetermined and the practice of adaptive management up to the opaque post-permit contacts between local Army Corps officials and permittees. This is indicative of how an elaborate theory has descended into a vague promise of future adjustments without clear standards. The litigation described in Part II provides many other examples of this devolution from theory to a/m-lite.³⁷

Some of the open-ended qualities of the Army Corps’ adaptive management policy could be explained as necessary given the nature of section 404 as regulating primarily private lands and actions³⁸—meaning the Army Corps takes proposed actions as they come and cannot know ahead of time how adaptive management can be effectively designed. But the story is little better for federal public land management agencies. There is no shortage of stakeholders interested in how public lands are managed and plenty of opportunities exist for them to chal-

See *Wetland Regulatory Authority*, U.S. EPA OFF. WATER, http://water.epa.gov/type/wetlands/outreach/upload/reg_authority.pdf (last visited Sept. 26, 2010).

35. 33 C.F.R. § 332.4(c)(12) (2009).

36. *Id.* § 332.7(c)(3).

37. See *infra* Part II.

38. Jason Scott Johnston, *The Tragedy of Centralization: The Political Economics of American Natural Resources Federalism*, 74 U. COLO. L. REV. 487, 620 n.361 (2003).

lenge agency decisions. The U.S. Forest Service and the DOI have led the way toward adaptive management among federal land management agencies. The Forest Service positioned adaptive management as the driver in its 2008 “environmental management systems” (EMS) rules for national forest planning,³⁹ and the DOI adopted a broad adaptive management policy for all its agencies in March 2007.⁴⁰ Still, details are lacking.

The Forest Service’s 2008 rule, for example, touts adaptive management over twenty times in the preamble,⁴¹ but only twice in the rule text: once to define it,⁴² and once to proclaim it is the essence of land management planning,⁴³ but never to explain how it is implemented. Instead, the agency adopted the concept of “environmental management systems” to, in theory (according to the preamble), capture all that is part of adaptive management and more.⁴⁴ The agency said it “believes incorporating EMS in the planning rule better integrates adaptive management and EMS in Forest Service culture and land management planning practices.”⁴⁵

The DOI approach is in one sense more substantive but in others more indirect. The DOI has proposed, as part of its rules implementing NEPA, that all its agencies adopt adaptive management, but does not therein define adaptive management or prescribe the contents of adaptive management plans.⁴⁶ Rather, the March 2007 DOI policy mandates use of a “technical guide” to define what adaptive management is and how an agency is

39. National Forest System Land Management Planning, 73 Fed. Reg. 21,468, 21,469 (Apr. 21, 2008) (emphasizing the need for a forest system management rule that “[p]romotes the use of adaptive management”).

40. See Secretary of the Interior, Order No. 3270, § 2 (Mar. 9, 2007) (“Consideration of [adaptive management] is warranted when: (a) there are consequential decisions to be made; (b) there is an opportunity to apply learning; (c) the objectives of management are clear; (d) the value of reducing uncertainty is high; (e) uncertainty can be expressed as a set of competing, testable models; and (f) an experimental design and monitoring system can be put in place with a reasonable expectation of reducing uncertainty.”).

41. National Forest System Land Management Planning, 73 Fed. Reg. at 21,469–505.

42. 36 C.F.R. § 219.16 (2009).

43. *Id.* § 219.3(a) (“Land management planning is an adaptive management process that includes social, economic, and ecological evaluation; plan development, plan amendment, and plan revision; and monitoring.”).

44. *Id.* § 219.5.

45. National Forest System Land Management Planning, 73 Fed. Reg. at 21,475.

46. Using Adaptive Management, 43 C.F.R. § 46.145 (2009).

to implement it.⁴⁷ The DOI adaptive management website presents a series of case studies to illustrate the technical guide in action, with contexts including multiple use lands, wildlife refuges, national forest restoration projects, and the Glen Canyon dam.⁴⁸ The guidance and the case studies do provide useful practical suggestions for adaptive management, but they do not aggregate into a coherent policy. The DOI nonetheless believes this approach “has great promise as an effective means to address significant resource management challenges under conditions of uncertainty.”⁴⁹ That, of course, will depend on how it is put into practice.

C. PRACTICE

Natural resource law is as much the management of conflict as it is the management of public lands, waters, or species. The first generation of litigation over adaptive management highlights two key disparities that are likely to exacerbate conflict and misunderstanding as agencies attempt to translate theory into action. One disparity arises from the different values evident in law and management. The other disparity separates scholarly adaptive management theory⁵⁰ from actual federal agency practice.

1. Perspectives on Agency Decisionmaking: Law Versus Management

Modern U.S. administrative law and many of the environmental statutes enacted over the past forty years value the transparency and certainty of two-step decisionmaking. The first step is the pluralist debate during which groups comment on draft documents and debate various alternatives. The second step is the final agency action, when the government throws the switch and makes the decision it will implement and defend if challenged in court. The legal system regards the point of final agency action as a phase change when the fluid

47. See WILLIAMS ET AL., *supra* note 29, at v.

48. See *Adaptive Management In Use*, U.S. DEPARTMENT INTERIOR, <http://www.doi.gov/initiatives/AdaptiveManagement/casestudies.html> (last modified Sept. 14, 2010).

49. Secretary of the Interior Order No. 3270, *supra* note 40, § 2.

50. For a discussion of adaptive management theory, see *supra* text accompanying notes 12–17.

period of deliberation ends and implementation/defense of a fixed record and plan of action begins.⁵¹

This decision method relies on two central attributes: (1) use of “front-end” analytical tools comprehensively conducted *and concluded* prior to making the decision final, and (2) the assumption of a robust capacity to predict and assess environmental impacts and overall costs and benefits of a proposed action.⁵² For example, regulations promulgated under the ESA provide for consultations between the FWS and other federal agencies about the impacts of actions on protected species. These regulations require the FWS to “[e]valuate the effects of the action and cumulative effects” and decide “whether the action, taken together with cumulative effects, is likely to jeopardize the continued existence of listed species.”⁵³ In other words, the FWS must decide, once and for all, whether an action taken today will jeopardize a species at some point in the future. The agency may revisit its decision only if the action remains subject to continuing federal control and either new information or modifications of the action present effects that were not previously considered.⁵⁴

51. See *Citizens to Preserve Overton Park v. Volpe*, 401 U.S. 402, 419–20 (1971) (holding that a record contemporaneous with agency deliberation must document the consideration of relevant factors supporting the decision—justifications offered after the final agency action cannot provide the legal support to uphold an agency action).

52. Professors Sidney Shapiro and Robert Glicksman have produced a rich body of scholarship exploring the “front-end” prediction approach to environmental agency decisionmaking. See SIDNEY A. SHAPIRO & ROBERT L. GLICKSMAN, *RISK REGULATION AT RISK: RESTORING A PRAGMATIC APPROACH*, at x (2003) (suggesting that pragmatism, rather than utilitarianism, is the “appropriate baseline from which to design and implement risk regulation”); Sidney A. Shapiro & Robert L. Glicksman, *Improving Regulation Through Incremental Adjustment*, 52 U. KAN. L. REV. 1179, 1179 (2004) (advocating a shift in focus from “front-end” regulatory adjustment to “back-end” regulatory improvements, including use of adaptive management); Sidney A. Shapiro & Robert L. Glicksman, *The Missing Perspective*, ENVTL. F., Mar.–Apr. 2003, at 42, 42 (“Instead of the increased ‘front end’ examination of regulations, such as cost-benefits analysis, that is pushed by the critics—and is causing stagnation of rulemaking—a pragmatic approach would look at a regulation’s actual ‘back end’ effects after promulgation and make incremental adjustments as needed.”).

53. 50 C.F.R. § 402.14(g)(3)–(4) (2009). The agency defines cumulative effects as “those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area.” *Id.* § 402.02.

54. See *id.* § 402.16.

As shown above, adaptive management in theory employs a much more complicated, multistep approach, which values the honing of predictive models and outcomes more than the fairness of the process.⁵⁵ Adaptive management theory regards decisionmaking as more of a series of fine-tuning steps that are continually and perpetually reevaluated.⁵⁶ The legal view of a resource management plan is that it comprehensively evaluates all rational considerations at once and then flips a toggle switch; the adaptive management approach twiddles the dial as information trickles in.

Adaptive management squares up much better with the needs of many contemporary resource management problems.⁵⁷ The comprehensive, front-end assessment methods of conventional resource management will likely face significant challenges in addressing problems such as climate change. The impacts of climate change necessitating human and environmental adaptation are excruciatingly difficult to predict.⁵⁸ Nonlinearities in change dynamics, environmental feedback properties, and the interactions of social and ecological responses will soon exceed the boundaries of knowledge and experience that have allowed environmental impact assessment and cost-benefit analysis to maintain what reliability and credibility they have.⁵⁹ Indeed, even before climate change adapta-

55. See *supra* text accompanying notes 12–17.

56. See *supra* text accompanying notes 12–17.

57. See *supra* Part I.A (discussing how ever-changing ecosystems require management policies that can adapt to new and uncertain climate conditions).

58. Many ecologists believe we face a “no-analog” future—one for which we have no experience on which to base projections of ecosystem change, and for which models designed to allow active management decisions as climate change takes effect are presently rudimentary and imprecise. See Peter Cox & David Stephenson, *A Changing Climate for Prediction*, 317 *SCIENCE* 207, 207 (2007); Matthew C. Fitzpatrick & William W. Hargrove, *The Projection of Species Distribution Models and the Problem of Non-Analog Climate*, 18 *BIODIVERSITY & CONSERVATION* 2255, 2255 (2009); Douglas Fox, *Back to the No-Analog Future?*, 316 *SCIENCE* 823, 823 (2007); Douglas Fox, *When Worlds Collide*, *CONSERVATION*, Jan.–Mar. 2007, at 28, 31.

59. The scientific literature exploring these complex dynamics and exposing our lack of understanding about what lies ahead as temperature rises is legion. See, e.g., U.S. CLIMATE CHANGE SCI. PROGRAM, THRESHOLDS OF CLIMATE CHANGE IN ECOSYSTEMS 74–84 (2009), available at <http://downloads.climate-science.gov/sap/sap4-2/sap4-2-final-report-all.pdf> (examining numerous positive feedback properties leading to nonlinear thresholds in climate change dynamics); Almut Arneth et al., *Clean the Air, Heat the Planet?*, 326 *SCIENCE* 672, 672–73 (2009) (examining the feedback effects between conventional air pollution control and climate change mitigation, and concluding that complex positive and negative feedback links exist and that, on balance, the

tion became a pressing need, the challenges of front-end environmental impact assessment were evident in ecological contexts that were increasingly understood to be exceedingly complex.⁶⁰

For example, a 1997 guide on considering cumulative effects under NEPA explains that “[d]etermining the cumulative environmental consequences of an action requires delineating the cause-and-effect relationships between the multiple actions and the resources, ecosystems, and human communities of concern. Analysts must tease from the complex networks of possible interactions those that substantially affect the resources.”⁶¹ The guide advises analysts to “gather information about the cause-and-effect relationships between stresses and resources” and to develop “a conceptual model of cause and effect . . . [with] [n]etwork[] and system diagrams [as] the preferred methods of conceptualizing cause-and-effect relationships.”⁶² Adaptive management seems more in tune with this approach than does conventional front-end decisionmaking.

The problem with adaptive management is that courts are better equipped to review toggle switching than dial twid-

evidence and models suggest that “air pollution control will accelerate warming in the coming decades”); Gordon B. Bonan, *Forests and Climate Change: Forcings, Feedbacks, and the Climate Benefits of Forests*, 320 SCIENCE 1444, 1444 (2008) (“[C]omplex and nonlinear forest-atmosphere interactions can dampen or amplify anthropogenic climate change.”); I. Eisenman & J.S. Wetlaufer, *Nonlinear Threshold Behavior During the Loss of Arctic Sea Ice*, 106 PROC. NAT’L ACAD. SCI. 28, 28 (2009) (describing the nonlinear “tipping points” in the ice-albedo feedback effect); Jerome Gaillardet & Albert Galy, *Himalaya—Carbon Sink or Source?*, 320 SCIENCE 1727, 1727–28 (2008) (explaining the uncertainties of the sinks and sources of the carbon geological cycle); Steven W. Running, *Ecosystem Disturbance, Carbon, and Climate*, 321 SCIENCE 652, 652–53 (2008) (explaining the uncertainties of ecological sinks and sources and how they might be impacted by episodic disturbances such as fires and insect epidemics).

60. See generally Daniel A. Farber, *Probabilities Behaving Badly: Complexity Theory and Environmental Uncertainty*, 37 U.C. DAVIS L. REV. 145 (2003) (discussing environmental complexity theory, which suggests that environmental events do not follow typical statistical distributions and are, thus, extremely difficult to plan for or predict); J.B. Ruhl, *Thinking of Environmental Law as a Complex Adaptive System: How to Clean up the Environment by Making a Mess of Environmental Law*, 34 HOUS. L. REV. 933 (1997) (explaining how the subject matter of environmental law consists of “interlinked complex adaptive systems,” the existence of which pose unique problems in terms of environmental management and regulation).

61. COUNCIL ON ENVTL. QUALITY, *CONSIDERING CUMULATIVE EFFECTS UNDER THE NATIONAL ENVIRONMENTAL POLICY ACT*, at vi (1997).

62. *Id.* at 38.

dling.⁶³ As the previous section demonstrated, agency policies for implementing adaptive management arose in a statutory vacuum and are themselves largely devoid of legal details.⁶⁴ While judges might generally understand the rationale for adaptive management and worry about discouraging experimentation that will lead to better conservation outcomes, the absence of clear statutory authority and well-defined regulatory standards will likely make evaluating agency adaptive management plans a struggle.⁶⁵ There are no statutory standards for oversight, no concrete legal definitions for determining what qualifies as adaptive management, and few binding steps in adopting adaptive management.⁶⁶ In rejecting “cookbooks” for adaptive management, agencies have failed to fill in the gaps left by statutes that either predate, ignore, or simply mention adaptive management in passing.⁶⁷ Agency policies support adaptive management as “learning while doing,” but courts are bound to review agency behavior in accordance with laws premised on a different paradigm. Part II of this Article reviews the court decisions relating to this disparity between agency policies and traditional administrative law and describes how judges attempt to reconcile it.

2. Adaptive Management: Theory Versus Practice

If one disparity in judicial interpretation arises from the disconnect between adaptive management and conventional administrative law, the second key disparity arises from the gap between the theory of adaptive management as explored in the scholarly literature and the practice as manifest in the actual plans agencies label as “adaptive management.” The “learning while doing” policy approach to adaptive management, although formless in substance, could have accommodated agencies’ implementation of adaptive management by adopting plans that fulfill the theory of adaptive management. But the fiscal realities of natural resources management in the field demand bare-bones approaches to project planning and

63. See *infra* Part II (discussing how courts have analyzed the legality of adaptive management).

64. See *supra* Part I.B (describing how adaptive management lacks a concrete definition or framework of statutory guidance and, thus, is difficult to implement in practice).

65. See *supra* Part I.B.

66. See *supra* Part I.B.

67. See *supra* Part I.B.

conservation.⁶⁸ In this lean environment, the incentives for field-level resource managers are to get the doing done through triage and to save the learning for better times.

Indeed, as the agency policies discussed above and the cases explored in Part II illustrate, agencies in practice have employed what we call “a/m-lite,” a stripped-down version of adaptive management that almost always neglects to develop testable hypotheses as the basis for management actions.⁶⁹ Often a/m-lite fails even to structure a learning procedure, whether through experimentation, historical research, or modeling.⁷⁰ Furthermore, lack of follow-through plagues implementation. As the cases show, there are other dimensions to the agency plans that depart from adaptive management theory because of limited funding.⁷¹ This a/m-lite approach, in its most extreme form, is open-ended contingency planning or “on-the-fly” management that promises some loosely described response to whatever circumstances arise. Some a/m-lite implementation can fairly be considered a passive form of adaptive management, suitable to circumstances where the range of possible variations in actions and outcomes are small.⁷² But a/m-lite may also slip into “basic trial and error learning in which explicit hypotheses are absent or vague,” or there may be

68. See Robert L. Fischman, *Predictions and Prescriptions for the Endangered Species Act*, 34 ENVTL. L. 451, 471–75 (2004) (explaining how many environmental laws do not allocate the funds necessary to operate at optimum levels); see also OUTDOOR RES. REVIEW GRP., GREAT OUTDOORS AMERICA 4 (2009), available at http://www.orrgroup.org/documents/July2009_Great-Outdoors-America-report.pdf (finding appropriations to be “woefully inadequate to meet identified needs for land and water conservation and outdoor recreation”); Caitlin A. Burke et al., *Policy News: Natural Resource Agency Funding*, 32 WILDLIFE SOC’Y BULL. 260, 262 (2004) (“Working to achieve enhanced funding and sound policies for wildlife conservation has always been important for wildlife professionals, but now—in this time of budget shortfalls—it is essential.”).

69. See Doremus, *supra* note 1, at 562 (“The potential for learning has too often been ignored in environmental regulation and natural resource management.”).

70. See *id.*

71. See, e.g., *S. Fork Band Council v. U.S. Dep’t of the Interior*, 588 F.3d 718, 725–26 (9th Cir. 2009) (*per curiam*) (describing a hastily prepared EIS that the court held inadequate due to its lack of detail).

72. See R. Gregory et al., *Deconstructing Adaptive Management: Criteria for Applications to Environmental Management*, 16 ECOLOGICAL APPLICATIONS 2411, 2412 (2006) (distinguishing active adaptive management, which hews closely to the theoretical model, from passive adaptive management, which retains some of the benefits of the theoretical approach while sacrificing some scientific rigor).

a complete lack of monitoring and meaningful adjustments.⁷³ At its worst, a/m-lite may be a pretext for postponing difficult, but important, decisions in order to dodge the constraints of budgets, politics, or scientific uncertainty.⁷⁴

The difference between adaptive management, as practiced, and the adaptive management concept universally praised as essential for dealing with the complexities of natural systems does not illustrate a disagreement about how adaptive management should work as much as it reveals the budgetary and political limitations of agencies responsible for implementation.⁷⁵ After all, we cannot expect agencies to carry out projects for which they have no funding. Moreover, adaptive management cannot dissolve the political conflicts that surround competition for scarce resources.⁷⁶

Nonetheless, the gap between theory and practice raises an important concern about bait and switch. Agencies base their departure from the conventional, comprehensive rationality model on the literature arguing that adaptive management is a superior approach.⁷⁷ But as the examples in Part II show, the policies and rules agencies have adopted leave them plenty of room to implement something different from the adaptive management approach supported by the management literature. Our concern is whether the agency-implemented a/m-lite is enough of an improvement over the comprehensive rationality assumption of front-end decisionmaking to justify the loss of certainty and transparency. This concern is particularly important because adaptive management is most often invoked as a tool to handle decisionmaking in the face of uncertainty.⁷⁸ Theoretical adaptive management reduces uncertainty over time, as experiments yield insights about how ecosystems re-

73. *Id.*

74. *See id.* at 2411.

75. *See id.*

76. *See* Carol Hirschon Weiss, *The Experimenting Society in a Political World*, in *VALIDITY & SOCIAL EXPERIMENTATION* 283, 284 (Leonard Bickman ed., 2000) (discussing the view that politics play an important role “in influencing how feasible . . . advocacy of experimental reform [can] be”).

77. *See supra* Part I.A (discussing the theories that have caused adaptive management to become a popular modern approach to environmental regulation).

78. *See supra* Part I.A (describing how ever-changing ecosystems demand management policies that can keep pace with changing conditions).

spond to various interventions.⁷⁹ But a/m-lite, which typically neglects hypothesis testing, does not help in this manner.⁸⁰ Even when it does specify a hypothesis to test, management practice often shortchanges evaluation. Part II of this Article examines this disparity by analyzing cases that have engaged the courts in disagreements about what constitutes legal adaptive management.

II. LITIGATION OVER ADAPTIVE MANAGEMENT

In a relatively short time, the adaptive management label for agency resource management plans has become ubiquitous. Since 1993, each of the major federal resource management agencies has made a policy commitment to employ adaptive management.⁸¹ At one time, a casual reader of a draft Environmental Impact Statement (EIS) could predict which alternative an agency would likely prefer by identifying the one that included “balanced approach” in its title.⁸² Over the past decade the tip-off has become “adaptive.”⁸³

79. See Doremus, *supra* note 1, at 549 (“[I]t is possible to reduce uncertainty over time in ways that are relevant to subsequent iterations or related decisions.”).

80. See *id.* at 569 (discussing how adaptive management is often used as a means to “muddle through” and act in the face of uncertainty “without any enforceable requirements for learning or incorporating new knowledge”).

81. Many of these are discussed *infra* in Part II.B. The Northwest Power Planning Council was the most important early adopter when it employed “adaptive management” in its 1982 Columbia Basin Fish and Wildlife Program to address pervasive scientific uncertainty regarding salmon recovery. See *Nw. Res. Info. Ctr. v. Nw. Power Planning Council*, 35 F.3d 1371, 1380 (9th Cir. 1994). Adaptive management continues to be the organizing principle for fish conservation in the Columbia Basin today. See NAT’L OCEANIC & ATMOSPHERIC ADMIN. ET AL., FCRPS ADAPTIVE MANAGEMENT IMPLEMENTATION PLAN: 2008–2018 FEDERAL COLUMBIA RIVER POWER SYSTEM BIOLOGICAL OPINION (2009), available at http://www.salmonrecovery.gov/Files/BiologicalOpinions/AMIP_091009.pdf (purporting to strengthen the agencies’ 2008 biological opinion—which the U.S. District Court in *National Wildlife Federation v. National Marine Fisheries Service*, 524 F.3d 917 (9th Cir. 2008), remanded for being structurally flawed under the ESA—by, inter alia, establishing new biological triggers to activate short- and long-term responses, and providing a rapid response to any detected significant decline in fish populations).

82. See, e.g., *Or. Natural Desert Ass’n v. Singleton*, 47 F. Supp. 2d 1182, 1195 (D. Or. 1998) (stating that the preferred alternative is one which articulates an intention to provide a “balanced approach” to protecting Oregon’s rivers); *Am. Motorcyclist Ass’n v. Watt*, 534 F. Supp. 923, 928 (C.D. Cal. 1981) (demonstrating that the Bureau of Land Management takes a balanced approach to conservation planning).

83. See, e.g., U.S. DEPT OF THE INTERIOR, RECORD OF DECISION: FINAL

Therefore, it was inevitable that courts would be called upon to evaluate how well the “adaptive” alternatives selected by agencies meet legal requirements. Every year, more and more published federal court decisions employ the term “adaptive management.” However, most cases using or even discussing the term “adaptive management” focus on issues peripheral to the key disparities at the heart of this analysis. Because an increasing majority of new federal resource management decisions use an adaptive management framework, a steady stream of challenges to federal resource management decisions need to discuss the framework to set the stage for evaluating the unrelated legal challenges.

A May 13, 2010, search of Westlaw and LexisNexis reported 120 federal court decisions containing the phrase “adaptive management.”⁸⁴ That group can be distilled to sixty-nine cases involving a challenge to adaptive management of the environment or natural resources.⁸⁵ In most of those cases, courts

BISON AND ELK MANAGEMENT PLAN AND ENVIRONMENTAL IMPACT STATEMENT 4 (2007), available at <http://www.fws.gov/bisonandelkplan/ROD.pdf> [hereinafter BISON AND ELK PLAN] (choosing the “Adaptively Manage Habitat and Populations” alternative). Increasingly, however, it can be difficult to find an alternative in a resource management EIS that does not purport to be adaptive. See, e.g., Cal. Res. Agency v. U.S. Dep’t of Agric., No. C 08-1185 MHP, 2009 WL 6006102, at *16 (N.D. Cal. Sept. 29, 2009) (rejecting a challenge to a forest-plan EIS in which all alternatives employed adaptive management because the Forest Service is not compelled to evaluate alternatives incompatible with its “basic policy objectives” or its “fundamental policy choice”).

84. Our focus is on identifying and analyzing judicial decisions in which the court directly evaluates the legality of an agency’s use of adaptive management to implement a regulatory program. We recognize that there are likely many pieces of litigation involving disputes over, among other things, an agency’s use of adaptive management that does not produce a judicial opinion directly assessing its legality. Some judicial opinions might also evaluate the legality of a specific agency action designed to implement adaptive management without ever mentioning adaptive management as the agency’s fundamental guiding motivation; though our impression is that as much as agencies advertise their purported use and implementation of adaptive management in policy documents, they would be no less eager to do so in court filings. Identifying and analyzing cases in both of these categories of cases would be important to gain a complete understanding of how adaptive management has fared in the judicial forum. The most important cases for our purposes, however, are those in which a court speaks directly to the use and legality of adaptive management. The language of these judicial opinions most substantively forms the jurisprudence of adaptive management.

85. The disparity between “decisions” and “cases” represents the fact that thirteen disputes (i.e., cases) produced more than one court decision. E.g., Pac. Coast Fed’n of Fishermen’s Ass’ns v. Gutierrez, 606 F. Supp. 2d 1122 (E.D. Cal. 2008). No single case produced more than one decision applying the law directly to adaptive management.

did not directly apply law to the adaptive aspect of the agency action. Instead, the courts employed the term to describe the action before getting to the legal issues dispositive to the case.⁸⁶

Nonetheless, thirty-one federal court decisions do grapple with the legality of adaptive management. The United States lost more than half of these cases,⁸⁷ a poor record given the deference accorded to agencies under administrative law.⁸⁸ It is these cases that reveal the most about the two key disparities highlighted previously: (1) between the principles underlying law and adaptive management, and (2) between adaptive management in theory and a/m-lite in practice. This study of the first round of litigation emerging from the federal consensus that natural resources agencies should practice adaptive management yields three key lessons about how those disparities have worked out in the courts: (1) larger-scale plans are more likely to incorporate successful adaptive management plans than smaller ones;⁸⁹ (2) the practice of tiering site-specific environmental impact analyses to an earlier, overarching, cumulative study is well suited to adaptive management, and adaptive management can reduce the need for a supplemental EIS;⁹⁰ and (3) adaptive management procedures, no matter how finely crafted, cannot substitute for showing that a plan will meet the substantive management criteria required by law.⁹¹

To set the stage for the analysis of these three themes, three sweeping observations are in order. First, it is worth not-

86. See, e.g., *Se. Conference v. Vilsack*, 684 F. Supp. 2d 135, 139 (D.D.C. 2010) (mentioning that the plan in question employs adaptive management, but recognizing that the disposition of the case actually turns on the definition of “withdrawal” under 16 U.S.C. § 3213(a), rather than the legality of adaptive management).

87. Not all of the government losses were due to problems with adaptive management. For instance, the Ninth Circuit overturned the 2004 Sierra Forest Framework for NEPA violations while upholding its adaptive management component. See *infra* notes 130–41 and accompanying text (discussing the analysis of the 2004 Sierra Forest Framework and the legitimacy of adaptive management techniques).

88. While the loss record for the United States is poor in these cases compared to administrative litigation overall, natural resource challenges generally fair better for plaintiffs in court than one would expect given the deferential standard of review. See Denise M. Keele et al., *Forest Service Land Management Litigation 1989–2002*, 104 J. FORESTRY 196, 198 (2006) (discussing how, of the 729 cases challenging Forest Service resource management decisions, the agency won only 57.6 percent).

89. See *infra* Part II.A.

90. See *infra* Part II.B.

91. See *infra* Part II.C.

ing that a court upholding an a/m-lite approach does not necessarily endorse the practice as advancing the goals of either law or conservation policy. It simply means that the use of a/m-lite did not run afoul of any specific legal requirement or substitute for a required finding or procedure.⁹² While courts may approve agency actions that involve terrible applications of adaptive management, it is fair to say that the most vague and incomplete plans have a greater likelihood of remand.⁹³

Second, many decisions applying the administrative law standards of deference to agency expertise do not involve adaptive management, but are relevant to understanding how courts regard it. For instance, the rigor with which an agency should explore the effects of similarly situated actions before committing to a new one is central to many natural resource cases.⁹⁴ The active learning component of adaptive management makes these cases relevant even if they did not review plans that purported to apply adaptive management. Therefore, we bring to bear on the question of how courts apply law to adaptive management cases beyond the relatively small sample of decisions that have already evaluated specific challenges to adaptive management.⁹⁵

Third, regardless of the particular outcome of judicial review, courts generally wish to support the trend toward adaptive management.⁹⁶ They seem to understand that arguments

92. See, e.g., *Env'tl. Prot. Info. Ctr. v. U.S. Fish & Wildlife Serv.*, No. C 04-04647 CRB, 2005 WL 3021939, at *7 (N.D. Cal. Nov. 10, 2005) (demonstrating that the court did not pass judgment on the wisdom of an adaptive management approach, but still found that the approach satisfied NEPA planning requirements).

93. See, e.g., *Klamath-Siskiyou Wildlands Ctr. v. Bureau of Land Mgmt.*, 387 F.3d 989, 997 (9th Cir. 2004) (holding that a general discussion of an environmental problem across a large area did not satisfy NEPA).

94. See *Lands Council v. McNair*, 537 F.3d 981, 991–92 (9th Cir. 2008) (refusing to analyze whether the agency incorporated adaptive learning from prior logging projects before beginning another, similar project); see also *infra* note 243 and accompanying text (discussing the implications of the *Lands Council v. McNair* case in greater depth).

95. E.g., *S. Fork Band Council v. U.S. Dep't of the Interior*, 588 F.3d 718 (9th Cir. 2009) (per curiam) (providing an example of how courts deal with resource management plans that are relatively vague and general in scope); see also *infra* note 227 and accompanying text (discussing the problems of open-ended contingency planning).

96. See, e.g., *Cal. Res. Agency v. U.S. Dep't of Agric.*, No. C 08-1185 MHP, 2009 WL 6006102, at *16 (N.D. Cal. Sept. 29, 2009) (accepting a limitation on the range of alternatives considered in a national forest plan's EIS to exclude strategies other than adaptive management).

in the conservation management literature all regard adaptive management as the best-suited decisionmaking technique for ecosystems.⁹⁷ Indeed, at least one court has come close to *requiring* adaptive management in holding that ESA HCPs must contain some provision to respond to unforeseen circumstances.⁹⁸ Courts sometimes explicitly state that they do not wish to create disincentives for using adaptive management.⁹⁹ Even where adaptive management plans have run afoul of judicial review, courts are careful to state that only the particular application in the case at hand is illegal, not adaptive management itself.¹⁰⁰ It is fair to conclude from this litigation that courts, despite their roots in the conventional administrative law model of a phase change at the time of final agency action, generally give agencies wide berth within statutory constraints to alter traditional planning approaches to accommodate adaptive management.

A. BIGGER IS BETTER

Spatial and temporal scale is a critical component of adaptive management.¹⁰¹ Applying adaptive management through larger area, longer time frame plans has tended to produce better outcomes for agencies in the courts.¹⁰² Though this may be due to the larger budgets associated with developing (and to a lesser extent, implementing) the plans, the primary advantage

97. *See id.*

98. *Sw. Ctr. for Biological Diversity v. Bartel*, 470 F. Supp. 2d 1118, 1144 (S.D. Cal. 2006); *see also* discussion *infra* note 215.

99. *See, e.g.,* *Env'tl. Prot. Info. Ctr. v. U.S. Fish & Wildlife Serv.*, No. C 04-04647 CRB, 2005 WL 3021939, at *7 (N.D. Cal. Nov. 10, 2005) (holding that the agency's implementation of an adaptive management plan does not constitute a "major federal action" under NEPA, therefore sparing it from the requirement of preparing a supplemental EIS and making the plan easier to put into place).

100. For example, *see Northwest Resources Information Center, Inc. v. Northwest Power Planning Council*, 35 F.3d 1371, 1380 n.18 (9th Cir. 1994), where the court described adaptive management as "scientifically sound," but rejected particular aspects of the government's implementation of the plan.

101. *See* Robert L. Fischman & Jaelith Hall-Rivera, *A Lesson for Conservation from Pollution Control Law: Cooperative Federalism for Recovery Under the Endangered Species Act*, 27 COLUM. J. ENVTL. L. 45, 146-48 (2002) (summarizing the benefits of large-area plans).

102. *See, e.g.,* *Seattle Audubon Soc'y v. Lyons*, 871 F. Supp. 1291, 1311 (W.D. Wash. 1994) (suggesting that compliance with environmental protection statutes requires planning on a scale that considers the entire ecosystem), *aff'd sub nom.* *Seattle Audubon Soc'y v. Moseley*, 80 F.3d 1401, 1404-06 (9th Cir. 1996) (per curiam).

enjoyed by large-scale plans is slack.¹⁰³ The larger the plan, the more room there is for trade-offs between competing interests, zones with different dominant uses (including control areas for experiments), and flexibility for revising management guidelines to reflect lessons learned.¹⁰⁴ Larger plans tend to employ a version of adaptive management that comes closer to the model in the scholarly literature than do smaller-scale plans.¹⁰⁵ The literature addressing how conservation can adapt to climate change also highlights the greater utility of larger spatial and temporal scale planning.¹⁰⁶

The litigation over adaptive management discussed in the remainder of Part II.B also reflects the advantages of the larger-scale plans. Four major adaptive management efforts constitute about half of the federal litigation grappling with the concept. With a few notable exceptions, discussed below, federal agencies in these four areas have experienced success in persuading courts to defer to their management choices and adaptive plans. Two of the efforts deal with forest management: the Northwest Forest Plan, covering 24.4 million acres in Washington and Oregon, and the Sierra Forest Framework, covering 11.5 million acres in California. The other two deal with water infrastructure: management of the Sacramento-San Joaquin River Delta (and its related infrastructure supplying water to the Central Valley) and operation of the Missouri River works controlled by the Army Corps.

103. See Fischman & Hall-Rivera, *supra* note 101, at 147 (noting that larger-scale plans are “more flexible because [they disperse] the burden of preservation or restriction of development over a broad area to allow for more trade-offs”).

104. This mirrors the experience of habitat conservation planning under the ESA. See *id.* at 147–48 (“Just as flexibility to trade off between habitat conservation and degradation shrinks with the geographic size of the plan, it also diminishes over time as a species becomes more imperiled.”). *But see* Gregory et al., *supra* note 72, at 2423 (highlighting the problems of large-scale, long-term experimental design, and noting the failures in applying adaptive management to the Columbia River Basin and the Everglades).

105. See Fischman & Hall-Rivera, *supra* note 101, at 147 (suggesting that larger plans more closely follow adaptive management techniques because they are more comprehensive, and less piecemeal, than smaller plans).

106. See, e.g., Brad Griffith et al., *Climate Change Adaptation for the US National Wildlife Refuge System*, 44 ENVTL. MGMT. 1043, 1043 (2009) (noting that “[g]eographic isolation and small unit size compound the challenges of climate change,” which means that “strategic response requires system-wide planning”).

The Northwest Forest Plan (NWFP) is one of the earliest large-scale adaptive management efforts,¹⁰⁷ and one of the most successful in attracting support from the courts for the adaptive management concept. Its age and scope make it the champion survivor of dozens of rounds of litigation. The NWFP resulted from a compromise brokered by President Clinton, who played an unprecedented (and, to date, unemulated) personal role in shaping the contours of the compromise it represented between timber and environmental interests.¹⁰⁸ The immense plan is strikingly complex, but in general outline it consisted of four elements: land allocation, aquatic conservation strategy, survey and monitoring requirements, and adaptive management.¹⁰⁹

The goal of the NWFP, originally completed in 1994, is to allow for substantial timber harvesting while maintaining the forest characteristics that support viable populations of northern spotted owls, salmon runs that breed in forest streams, and hundreds of other species sensitive to logging operations.¹¹⁰ Adaptive management plays a leading role in two aspects of the plan: administration of lands specially designated for adaptive management experimentation, and as a general principle for implementation and revision of the overall set of management

107. The Northwest Power Planning Council was an agency that sought to use adaptive management in a large-scale plan early on with the 1982 Columbia Basin Fish and Wildlife Program. See *Nw. Res. Info. Ctr., Inc. v. Nw. Power Planning Council*, 35 F.3d 1371, 1380–83 (9th Cir. 1994) (discussing the implementation of the 1982 plan and subsequent adaptations).

108. See U.S. DEP'T. OF AGRIC. ET AL., RECORD OF DECISION FOR AMENDMENTS TO FOREST SERVICE AND BUREAU OF LAND MANAGEMENT PLANNING DOCUMENTS WITHIN THE RANGE OF THE NORTHERN SPOTTED OWL 1 (1994) [hereinafter ROD NORTHERN SPOTTED OWL], available at <http://www.reo.gov/library/reports/newroda.pdf> (identifying the conference held by President Clinton as a catalyst for the NWFP); STEVEN L. YAFFEE, THE WISDOM OF THE SPOTTED OWL 141–43 (1994) (describing the conference and its surrounding circumstances).

109. Both a Record of Decision and an EIS were based on FOREST ECOSYSTEM MGMT. ASSESSMENT TEAM, FOREST ECOSYSTEM MANAGEMENT: AN ECOLOGICAL, ECONOMIC, AND SOCIAL ASSESSMENT, at II-3 to II-4 (1983) [hereinafter FEMAT REPORT] (discussing the general approach of the plan). See generally U.S. DEP'T OF AGRIC. ET AL., FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT ON MANAGEMENT OF HABITAT FOR LATE-SUCCESSIONAL AND OLD-GROWTH FOREST RELATED SPECIES WITHIN THE RANGE OF THE NORTHERN SPOTTED OWL (1994) (demonstrating that two documents based on the FEMAT report were similarly complex and focused).

110. See FEMAT REPORT, *supra* note 109, at II-1 to II-2 (outlining numerous goals of the FEMAT Report).

prescriptions for the NWFP.¹¹¹ As we later discuss, it is this second aspect of adaptive management in the NWFP that has generated litigation.

The land-allocation zones fall into three categories.¹¹² Some seventy-eight percent of the lands covered by the NWFP are designated late-successional reserves, where maintaining and encouraging the development of old-growth forests is the primary aim.¹¹³ Some logging consistent with this aim, such as thinning to promote or enhance old-growth attributes, occurs in this category.¹¹⁴ Most of the timber output, however, comes from the second category, the matrix lands between the reserves. The third category designates ten zones ranging from 84,000 to 400,000 acres to serve as “adaptive management areas,” where experiments with adaptive management would be the primary purpose.¹¹⁵ Though the track record of the adaptive management areas does offer some general lessons for improving adaptive management generally, the unique mandate limits their application.¹¹⁶ The true test of NWFP adaptive management is its success in guiding the vast majority of lands designated matrix or reserve, where balancing timber production against environmental values generated—and continues to generate—enormous controversy.¹¹⁷ It is the lands not specifi-

111. See *id.* at II-4 (discussing the development of long-term management alternatives); *id.* at II-11 to II-12 (identifying adaptive management areas as places used to test and develop management approaches).

112. The Record of Decision actually identifies seven different types of land allocations, but those allocations fit into categories of reserves, land allowing for timber output, and land for adaptive management. See ROD NORTHERN SPOTTED OWL, *supra* note 108, at 6–7.

113. See *id.* at 29.

114. See *id.* at 62–63 (discussing the importance of thinning).

115. FEMAT REPORT, *supra* note 109, at III-24, III-30 to III-33 (identifying the regions to be used as adaptive management areas).

116. For discussions on the track record of adaptive management areas, see generally, GEORGE H. STANKEY & BRUCE SHINDLER, ADAPTIVE MANAGEMENT AREAS: ACHIEVING THE PROMISE, AVOIDING THE PERIL (1997), available at ftp://ftp.blm.gov/pub/blmlibrary/BLMpublications/AdaptiveManagement/AdaptiveMgmtTechGuide/CDReferences/Stankey_1997_Adaptive%20Management%20Areas%20-%20Achieving%20the%20Promi.pdf; Andrew N. Gray, *Adaptive Ecosystem Management in the Pacific Northwest: A Case Study from Coastal Oregon*, CONSERVATION ECOLOGY (Nov. 23, 2000), <http://www.ecologyandsociety.org/vol4/iss2/art6/>; Forest Fleischman, *Bureaucracy, Collaboration and Co-production: A Case Study of the Implementation of Adaptive Management in the U.S.D.A. Forest Service* (Apr. 15, 2008) (unpublished manuscript), available at http://www.indiana.edu/~workshop/publications/materials/conference_papers/fleischman.pdf.

117. The leading analysis of how well the NWFP modeled actual adaptive

cally set aside for adaptive management experiments where the NWFP experience most closely resembles routine federal conservation policy challenges.

The overarching NWFP mandate for adaptive management through monitoring and evaluation involved multiple levels of planning to restrict disturbance to riparian areas in an “aquatic conservation strategy” (ACS) and “survey and manage” (S&M) requirements for over 400 species, with some triggering population surveys before ground-disturbing activity, such as logging. Courts rejected challenges to the original NWFP, including its adaptive elements.¹¹⁸ Subsequently, the ACS and S&M provisions of the NWFP were common bases for judicial remands overturning timber sales.¹¹⁹ Appropriations and political will never fully supported implementation of these components of adaptive management, but the framework for forest management remains a workable process for some projects.¹²⁰ Still, the adaptive management requirements and the degraded conditions of the forests in the NWFP resulted in far less logging than promised.¹²¹

management is B.T. Bormann et al., *Adaptive Management of Forest Ecosystems: Did Some Rubber Hit the Road?*, 57 *BIOSCIENCE* 186, 186 (2007), who explore “the concepts of adaptive management as they were developed [through FEMAT] and applied on federal lands through the Northwest Forest Plan.”

118. *E.g.*, *Seattle Audubon Soc’y v. Lyons*, 871 F. Supp. 1291, 1310–17 (W.D. Wash. 1994), *aff’d sub nom.* *Seattle Audubon Soc’y v. Moseley*, 80 F.3d 1401, 1404–06 (9th Cir. 1996) (per curiam).

119. *See, e.g.*, *Pac. Coast Fed’n of Fishermen’s Ass’ns v. Nat’l Marine Fisheries Serv.*, 265 F.3d 1028, 1037–38 (9th Cir. 2001) (emphasizing the ACS’s short-term protections that work to ensure the habitat will support the migration cycles of salmon, while also finding that the long-term recovery of the aquatic habitat may not be sufficient to comply with the NWFP); *Or. Natural Res. Council Action v. U.S. Forest Serv.*, 59 F. Supp. 2d 1085, 1093–94 (W.D. Wash. 1999) (emphasizing the importance of S&M to the NWFP process because finding new populations of sensitive species before logging allows for the placement of protections).

120. *See* K. Norman Johnson et al., *Forest Ecosystem Management Assessment Team Assessments*, in *BIOREGIONAL ASSESSMENT: SCIENCE AT THE CROSSROADS OF MANAGEMENT AND POLICY* 85, 107–11 (K. Norman Johnson et al. eds., 1999) (discussing measurements for success and support of adaptive management in the NWFP). Nonetheless, new circumstances, including the incursion of aggressive barred owls and climate change, have prompted the Obama Administration to begin a revision of the recovery plan for the Northern Spotted Owl in the NWFP. *See* April Reese, *New Threats Could Undermine Obama Administration’s Plan for Northern Spotted Owl*, *LAND LETTER* (Apr. 9, 2009), <http://www.eenews.net/Landletter/print/2009/04/09/2>.

121. *See* Johnson et al., *supra* note 120, at 107–09 (discussing the failure to meet goals for forest outputs).

In response to the underperformance of the NWFP in producing cut timber, the George W. Bush Administration adopted amendments in 2004 that unsuccessfully attempted to relax two key elements of adaptive management: the ACS and the S&M rules.¹²² The issues with both actions are similar, but the court more thoroughly explored the issues in the context of S&M. A district court overturned the 2004 amendments to the NWFP that removed the S&M requirement for insufficient environmental analysis in the EIS.¹²³ The original 1994 EIS for the NWFP justified the S&M standard as needed to gain information to ensure viability for a host of species, a core adaptive function.¹²⁴ The court agreed with the government that it could change its opinion about the best way to balance goals in the NWFP, but it found that a change eliminating a fundamental standard of adaptive management requires thorough analysis and disclosure of the environmental consequences.¹²⁵ In other words, the adaptive framework of the NWFP depends on certain fundamental monitoring tools, such as S&M, that cannot be reversed without revisiting the original charter and analysis (in this case, the NWFP and its EIS). A similar effort by the Bureau of Land Management to eliminate pre-logging surveys for the red tree vole (prey for spotted owls) met the same fate for failure to revise the underlying, large-scale adaptive management plans.¹²⁶

The Sierra Forest Framework is smaller, younger, and subject to fewer lawsuits. Still, it offers a useful contrast with the NWFP in the use of adaptive management to modify a multi-forest management charter. In 2004 the Bush Administration significantly amended California's Sierra Forest Framework, which governs administration of eleven national forests in the Sierra Nevada Range.¹²⁷ The changes shifted the "management emphasis from biodiversity conservation and prescribed fire to

122. *Pac. Coast Fed'n of Fishermen's Ass'ns v. Nat'l Marine Fisheries Serv.*, 482 F. Supp. 2d 1248, 1251–53 (W.D. Wash. 2007) (overturning the Bush administration's ACS amendments); *Nw. Ecosystem Alliance v. Rey*, 380 F. Supp. 2d 1175, 1197–98 (W.D. Wash. 2005) (overturning the Bush Administration's S&M amendments).

123. *Nw. Ecosystem Alliance*, 380 F. Supp. 2d at 1192–93.

124. *Id.* at 1192.

125. *Id.* at 1193.

126. *Klamath Siskiyou Wildlands Ctr. v. Boody*, 468 F.3d 549, 560–61 (9th Cir. 2006).

127. *Sierra Forest Legacy v. Rey*, 577 F.3d 1013, 1018 (9th Cir. 2009).

aggressive mechanical thinning” and timber production.¹²⁸ One particularly contentious aspect of the 2004 framework expanded the number of trees that could be logged from those twelve to twenty inches in diameter to those up to thirty inches in diameter.¹²⁹ Although the Ninth Circuit found the 2004 framework flawed because its environmental impact analysis failed to consider a reasonable range of alternatives,¹³⁰ a district court evaluating a challenge to the adaptive management provisions endorsed the approach.¹³¹ The adaptive management amendments were able to take advantage of the large scale of the Framework to employ different “modules” in different areas to comprise an “integrated research project.”¹³² This, along with the use of modeling projections, is a principal reason why the 2004 Framework survived the allegation that the Forest Service deferred taking the required “hard look” at wildlife impacts of more logging.¹³³ Along with the NWFP, the 2004 Framework is one of the only adaptive management plans considered by courts that explicitly employed different management regimes in different areas to create experiments testing hypotheses about effects on forest fires and old-growth dependent species. In upholding the adaptive management approach, the district court fairly characterized the 2004 Framework as providing “more flexibility to strategically locate treatments across the landscape.”¹³⁴ The large area covered by the Framework made these elements of the plan easier to employ.

On the other hand, monitoring and mitigation modules do not necessarily lead to learning that can or will be applied to reshape projects. Indeed, the State of California complained that the Forest Service had increased the logging intensity in 2004 without having applied data from the earlier, more conservative adaptive management approach in the 2001 framework.¹³⁵ A federal district court recently upheld individual for-

128. Robert B. Keiter, *Breaking Faith with Nature: The Bush Administration and Public Land Policy*, 27 J. LAND RESOURCES & ENVTL. L. 195, 231 (2007).

129. *Sierra Forest Legacy*, 577 F.3d at 1018, 1020.

130. *Id.* at 1021–22.

131. *California ex rel. Lockyer v. U.S. Dep’t of Agric.*, No. 2:05-cv-0211-MCE-GGH, 2008 WL 3863479, at *16–17 (E.D. Cal. Sept. 3, 2008).

132. *Id.* at *19.

133. *Id.* at *4, *17–21.

134. *Id.* at *8.

135. State of California’s Memorandum of Points and Authorities in Support of Motion for Summary Judgment at 2, *California ex rel. Lockyer*, 2008 WL 3863479 (No. 2:05-cv-0211-MCE-GGH).

est plan amendments in the Sierra region against a challenge that reduced monitoring of sensitive species created a foreseeable risk of degradation through the activities, such as logging, authorized by the plans.¹³⁶ The court wrote that “it presumes too much to argue that [the previous, more detailed monitoring] obligations would have turned up information that would have inclined the Forest Service to significantly alter or modify a particular project.”¹³⁷ Though one can view the court’s decision as skepticism about the value of the additional monitoring, it also speaks to the absence of enforceable commitments in most a/m-lite to revise projects in light of monitoring.¹³⁸

It is also worth noting that big plans often enjoy special appropriations associated with congressional support of adaptive experiments.¹³⁹ In the case of the Sierra forests, the Herger-Feinstein Quincy Library Group Forest Recovery Act authorized specific funding for pilot projects.¹⁴⁰ Combined with the national priority to address fire risk and forest health, the high-profile Framework was able to secure funds for monitoring and response of management experiments.¹⁴¹ This funding is a rare, but reassuring, element of adaptive management practice that ameliorated the loss of certainty in management criteria occasioned by the 2004 amendments.

The most cited litigation endorsing the notion that adaptive management is compatible with NEPA and administrative

136. *Sierra Forest Legacy v. U.S. Forest Serv.*, 652 F. Supp. 2d 1065, 1088–91 (N.D. Cal. 2009).

137. *Id.* at 1090.

138. See, e.g., Alejandro E. Camacho, *Adapting Governance to Climate Change: Managing Uncertainty Through a Learning Infrastructure*, 59 EMORY L.J. 1, 47–48 (2009) (describing the problems with adaptive management implementation for portions of the Colorado River that flows downstream of the Glen Canyon Dam).

139. See, e.g., Act of Feb. 12, 1994, Pub. L. No. 103-211, ch. 3, 108 Stat. 3, 16 (1994) (earmarking funding for the NWFP). The Northwest Forest Plan program reported that it spent \$50 million for monitoring. VALERIE RAPP, NORTHWEST FOREST PLAN—THE FIRST 10 YEARS (1994–2003), at 11 (2008).

140. Herger-Feinstein Quincy Library Group Forest Recovery Act, Pub. L. No. 105-277, § 401, 112 Stat. 2681, 2681-307 to -308 (codified as amended at 16 U.S.C. § 2104 (1998)). Funding for the pilot projects totaled \$25.3 million in 2008, more than three times the amount appropriated in 1999. U.S. DEP’T OF AGRIC. ET AL., STATUS REPORT TO CONGRESS FISCAL YEAR 2008: HERGER-FEINSTEIN QUINCY LIBRARY GROUP FOREST RECOVERY ACT PILOT PROJECT 4 (2009), available at http://www.fs.fed.us/r5/hfqlg/monitoring/report_to_congress/2008/fy08_report_to_congress_letter.pdf.

141. *California ex rel. Lockyer v. U.S. Dep’t of Agric.*, No. 2:05-cv-0211-MCE-GGH, 2008 WL 3863479, at *19 (E.D. Cal. Sept. 3, 2008).

law concerns the Army Corps' management of the Missouri River, which it controls through dams. After the D.C. District Court enjoined a river-operating plan for failing to comply with the ESA,¹⁴² a series of cases beginning in 2004 have upheld the Army Corps' approach of employing adaptive management to balance the needs of wildlife dependent on the natural seasonal variation in flows (especially for the imperiled pallid sturgeon, least tern, and piping plover) with the interests of flood control and navigation.¹⁴³ Though the courts did not grapple with the adaptive management approach as deeply in this litigation as in the other examples we discuss, its use on this scale by the Army Corps is a significant step in the spread of comprehensive adaptive management plans beyond the traditional public land and wildlife agencies.

Probably the most complex of all the large-scale plans addresses the vast infrastructure diverting huge volumes of water coming down the Sacramento River, around the delta it shares with the San Joaquin River, and directing it to users further south.¹⁴⁴ The dams and diversions are operated jointly by state and federal agencies, and the environmental issues include wildlife, irrigation, flood risk, and potability of municipal water supplies for tens of millions of people.¹⁴⁵ The litigation challenging the adaptive management regimes pertaining to different species in the water system composes a mixed record.¹⁴⁶ As with the other examples discussed in this section, the large area covered by the watersheds and the large volumes of water certainly permit a wider array of trade-offs than can occur with

142. *Am. Rivers v. U.S. Army Corps of Eng'rs*, 271 F. Supp. 2d 230, 253–58 (D.D.C. 2003) (finding mere mitigation measures inadequate to meet the ESA, but launching a new biological opinion that triggered subsequent litigation in the Eighth Circuit).

143. *In re Operation of the Mo. River Sys. Litig.*, 516 F.3d 688, 690–94 (8th Cir. 2008) (finding that an EIS was not necessary because adaptive management flexibility was provided for in an earlier Record of Decision); *In re Operation of the Mo. River Sys. Litig.*, 421 F.3d 618, 635–36 (8th Cir. 2005) (allowing for flow adjustment based on subsequent information and providing for a focus on adaptive management).

144. *See Cent. Delta Water Agency v. U.S. Fish & Wildlife Serv.*, 653 F. Supp. 2d 1066, 1073 (E.D. Cal. 2009).

145. *See id.* at 1073–74.

146. *Compare Pac. Coast Fed'n of Fishermen's Ass'ns v. Gutierrez*, 606 F. Supp. 2d 1122, 1193–94 (E.D. Cal. 2008) (upholding adaptive management plan), *with Natural Res. Def. Council v. Kempthorne*, 506 F. Supp. 2d 322, 387–88 (E.D. Cal. 2007) (finding that the adaptive management plan failed to take into account sufficient information).

smaller projects.¹⁴⁷ But, in these Delta cases, the enormous complexity of the statutes, contracts, and governing bodies (both state and federal) likely undermined what would otherwise be a strong candidate for successful adaptive management. We will discuss how a single court approved one Delta adaptive management plan but remanded another in Part II.C, below, when we discuss the relationship between substantive legal standards and the adaptive process.

B. NEPA: EFFECTIVE USE OF TIERING AND REDUCED NEED FOR SUPPLEMENTS

The environmental impact analysis required by NEPA is perhaps the grandest expression of the comprehensive rationality worldview rejected by adaptive management.¹⁴⁸ So, it is somewhat surprising to find in NEPA practice a tool well suited to adaptive management: a/m-lite roots well in the soil of NEPA tiering. Tiering, a practice dating to the 1970s, permits agencies to proceed with broad programs without examining site-specific effects.¹⁴⁹ In situations such as the adoption of a forest plan, or a regional methane leasing program, the agency may defer the details of impact analysis until such time as it proposes a timber sale¹⁵⁰ or receives applications for permits to drill.¹⁵¹ The first NEPA tier concentrates on cumulative impacts of anticipated successive activities without evaluating the peculiar situations that may arise from any particular activity.¹⁵² Tiering relieves an agency from evaluating uncertain contingencies with tenuous connections to the overall impacts.¹⁵³

147. See *Natural Res. Def. Council*, 506 F. Supp. 2d at 327–47 (discussing the trade-offs that occur when assessing an adaptive management plan for the Central Valley Project).

148. See generally Bryan D. Jones, *Bounded Rationality*, 2 ANN. REV. POL. SCI. 297, 299 (1999) (describing comprehensive rationality).

149. See 40 C.F.R. §§ 1502.20, 1508.28 (2009); Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations, 46 Fed. Reg. 18,026, 18,033 (Mar. 23, 1981) (describing in question 24(c) the function of tiering).

150. See, e.g., *Klamath-Siskiyou Wildlands Ctr. v. Bureau of Land Mgmt.*, 387 F.3d 989, 992–93 (9th Cir. 2004).

151. See, e.g., *Wilderness Soc'y v. Salazar*, 603 F. Supp. 2d 52, 63–66 (D.D.C. 2009).

152. See Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations, 46 Fed. Reg. at 18,033.

153. See 40 C.F.R. § 1508.28 (“Tiering . . . helps the lead agency to focus on the issues which are ripe for decision and exclude from consideration issues already decided or not yet ripe.”).

The subsequent levels of NEPA compliance occur as particular, site-specific projects requiring approval.¹⁵⁴ At that point, the general discussions of the first tier may be incorporated by reference, and the EIS or EA will focus on just those issues specific to the particular activity.¹⁵⁵ In fact, a subsequent EIS will often be unnecessary if a particular project creates only effects already anticipated in the first tier EIS.¹⁵⁶ For site-specific projects, agencies commonly prepare environmental assessments concluding in findings of no significant impacts (FONSI) that go beyond those adumbrated by the original program's EIS.¹⁵⁷

Large-scale adaptive management generally involves a massive EIS intended to serve as an overarching analysis to which subsequent projects and adjustments may be tiered.¹⁵⁸ This is how the adaptive charter works to guide subsequent projects for the NWFP,¹⁵⁹ and the national forests in the Sierra Nevada Range.¹⁶⁰ Indeed, the adaptive elements of the EISs may even reduce the need for a subsequent supplemental EIS. In *Oregon Natural Resources Council Action v. United States Forest Service*,¹⁶¹ a court remanded a timber sale because it did not include the S&M required by the NWFP.¹⁶² The NWFP created binding law that the court ordered the agency to follow or amend.¹⁶³ However, the court rejected a NEPA claim that the United States needed to prepare a supplemental EIS to consider a variety of new information about forests, wildlife and, water quality that had emerged since the adoption of the NWFP.¹⁶⁴ The court rebuffed the claim by relying, in part, on

154. *See id.* § 1502.20.

155. *See id.* § 1508.28.

156. *See id.*

157. *See* Bradley C. Karkkainen, *Toward a Smarter NEPA: Monitoring and Managing Government's Environmental Performance*, 102 COLUM. L. REV. 903, 909–10 (2002) (explaining that a vast majority of environmental assessments result in a FONSI).

158. *See* Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations, 46 Fed. Reg. 18,026, 18,033 (Mar. 23, 1981).

159. *See, e.g.,* Seattle Audubon Soc'y v. Moseley, 80 F.3d 1401, 1403–04 (9th Cir. 1996) (per curiam) (noting the overarching EIS process).

160. *See, e.g.,* California *ex rel.* Lockyer v. U.S. Dep't of Agric., No. 2:05-cv-0211-MCE-GGH, 2008 WL 3863479, at *1–3 (E.D. Cal. Sept. 3, 2008).

161. 59 F. Supp. 2d 1085 (W.D. Wash. 1999).

162. *See id.* at 1091–94.

163. *Id.* at 1093.

164. *Id.* at 1096.

the adaptive management strategy in the NWFP.¹⁶⁵ The court determined that adaptive management anticipated that new information would emerge and provided mechanisms for adjustment.¹⁶⁶ This is an example of how the flexibility of adaptive management can ease the burden for an agency needing to comply with NEPA over the course of a very long-term project, such as restoring late-successional forests. A different judge in the same court later reached the same result in a challenge to a different timber sale after subsequent developments raised doubts about the NWFP's assumptions concerning logging on private land.¹⁶⁷ Again, the court relied on the adaptive management component of the NWFP to establish an assumption that no supplemental study would be needed absent a showing that the information could not be addressed by the adaptive process.¹⁶⁸

On the other hand, a subsequent decision justified as adaptive modification may go too far in changing the terms of the original framework in the first tier. In that case, courts require a supplemental EIS. In *Klamath Siskiyou Wildlands Center v. Boody*,¹⁶⁹ the Ninth Circuit enjoined timber sales in part because a change in the survey requirements for the red tree vole went too far beyond what the tier one NWFP EIS anticipated, even with adaptive management.¹⁷⁰ The federal government had argued that the decision to change the vole's S&M designation was within the adaptive latitude created by the NWFP.¹⁷¹ The court examined the NWFP EIS and disagreed.¹⁷² The lesson from *Klamath Siskiyou* is that an agency cannot tier when revising a fundamental standard of an overarching adaptive management plan.¹⁷³

Another risk posed by the attraction of tiering is that an agency will defer making controversial decisions on the basis that it can work out the details of a fairly vague commitment to

165. *Id.*

166. *Id.*

167. *See Hanson v. U.S. Forest Serv.*, 138 F. Supp. 2d 1295, 1301–04 (W.D. Wash. 2001).

168. *Id.* at 1304.

169. 468 F.3d 549 (9th Cir. 2006).

170. *Id.* at 561.

171. *Id.* at 560.

172. *Id.*

173. *See id.*

goals in subsequent tiers.¹⁷⁴ Unfortunately, the agency may be setting itself up for failure if it is unable to secure the resources to adequately tackle the difficult analysis in subsequent tiers. Also, vague commitments that do not include site-specific criteria may simply allow political momentum to overwhelm the plan's objective. In the EIS supporting the elk and bison management plan for the National Elk Refuge and nearby lands, the agency defined the (ultimately selected) "adaptive management" alternative as a plan implemented through a "structured framework . . . of adaptive management criteria and actions for transitioning from intensive supplemental winter feeding."¹⁷⁵ However, the plan neither describes the "structured framework" nor defines the "criteria." Given the strong local political support for maintaining supplemental winter feeding, opponents are understandably skeptical that such a vague commitment will result in a transition to more natural winter ranging behavior and lower elk populations.¹⁷⁶ The goal of the "adaptive management" alternative is to reduce the winter elk population of the region by nearly twenty percent,¹⁷⁷ but the path to achieve it is not evident in the plan. Deferring a firm decision to take a critical action, such as terminating winter feeding until a subsequent incremental adaptive process, may be a recipe for failure.¹⁷⁸ Yet adaptive management and tiering can make it easier for agencies to yield to the temptation to

174. Cf. 40 C.F.R. § 1502.20 (2009) (discussing the "broader statement" created in the first tier).

175. BISON AND ELK PLAN, *supra* note 83, at 65.

176. See Robert L. Fischman & Angela M. King, *Savings Clauses and Trends in Natural Resources Federalism*, 32 WM. & MARY ENVTL. L. & POLY REV. 129, 137–41 (2007). Defenders of Wildlife and other environmental groups have challenged the plan for these and other reasons. Complaint for Declaratory and Injunctive Relief ¶¶ 37–43, *Defenders of Wildlife v. Kempthorne*, 698 F. Supp. 2d 141 (D.D.C. 2010) (No. 08-CV-00945).

177. See BISON AND ELK PLAN, *supra* note 83, at 3, 19 (proposing a reduction in elk numbers from 13,000 to 11,000).

178. See Mary O'Brien, *Uneasy Riders: A Citizen, a Cow, and NEPA*, 39 ENVTL. L. REP. 10,632, at 10,633 (2009) (describing environmental impact analysis for Forest Service allotment management plans that respond to degraded conditions with "vague commitments to future adaptive management" without "clear triggers for applying the unspecified adaptive management measures"). Another example of deferring difficult decisions through adaptive management is the decision to adopt grazing allotments in the Sawtooth National Forest. See *W. Watersheds Project v. U.S. Forest Serv.*, No. CV 05 189 E BLW, 2006 WL 292010, at *2 (D. Idaho Feb. 7, 2006) (stating that the adaptive management strategy "did not define the protocols it would use or describe the monitoring that is the heart of the strategy").

dodge difficult, controversial decisions.¹⁷⁹ It is not surprising, then, that courts frequently reject adaptive management plans as too amorphous.¹⁸⁰ Professor Glicksman has characterized some of this litigation as standing for the principle that agencies may not rely “on adaptive management as an excuse for deferring real planning in favor of” an approach that promises to deal with expected future problems as they arise.¹⁸¹

Even if not amorphous, a promise to adaptively manage problems may not fulfill the NEPA requirement that agencies take a “hard look” at the impacts of their action. For instance, *High Sierra Hikers Association v. Weingardt*¹⁸² overturned a Forest Service decision to liberalize the rules limiting campfires in high country parts of a wilderness area.¹⁸³ Despite a record raising a number of problems with the decision, including disparate treatment of commercial-pack trips compared to private backpacking, physical impacts from fires and their residues, and potential introduction of exotic seeds and pathogens through packed wood, the Forest Service went forward with the looser rules on the basis that it could monitor and adjust in response to problems.¹⁸⁴ The court ruled that the agency could not rely on adaptive management to overcome an inadequate response to the problems raised in the record.¹⁸⁵

On the other hand, *Theodore Roosevelt Conservation Partnership v. Salazar (TRCP)*¹⁸⁶ rebuffed a claim that an adaptive management approach to handling site-specific and uncertain impacts violated the NEPA’s requirement to evaluate environ-

179. See Beth C. Bryant, *NEPA Compliance in Fisheries Management: The Programmatic Supplemental Environmental Impact Statement on Alaskan Groundfish Fisheries and Implication for NEPA Reform*, 30 HARV. ENVTL. L. REV. 441, 450 (2006).

180. See, e.g., *Greater Yellowstone Coal. v. Kempthorne*, 577 F. Supp. 2d 183, 209–10 (D.D.C. 2008); *Natural Res. Def. Council v. Kempthorne*, 506 F. Supp. 2d 322, 387 (E.D. Cal. 2007); *Mountaineers v. U.S. Forest Serv.*, 445 F. Supp. 2d 1235, 1250 (W.D. Wash. 2006); *Natural Res. Def. Council v. U.S. Army Corps of Eng’rs*, 457 F. Supp. 2d 198, 234–35 (S.D.N.Y. 2006). But see *Defenders of Wildlife v. Salazar*, 698 F. Supp. 2d 141, 149–50 (D.D.C. 2010) (upholding the National Elk Refuge’s elk management plan despite its amorphous adaptive management approach to reducing winter elk populations), *appeal docketed*, No. 08-cv-00945 (D.C. Cir. Mar. 26, 2010).

181. Glicksman, *supra* note 4, at 871.

182. 521 F. Supp. 2d 1065 (N.D. Cal. 2007).

183. *Id.* at 1090–91.

184. *Id.*

185. *Id.* at 1091.

186. No. 09-5162, 2010 WL 2869778 (D.C. Cir. July 23, 2010).

mental effects *before* an agency undertakes an action.¹⁸⁷ In contrast to *High Sierra Hikers Association*, which involved site-specific environmental analyses for each special use permittee and lifted an outright ban on campfires above specified elevations,¹⁸⁸ *TRCP* reviewed a broad plan (covering more than 270,000 acres in the Atlantic Rim of Wyoming) for natural gas development that did not yet authorize a specific ground-disturbing activity.¹⁸⁹ The *TRCP* court refused to read the NEPA regulations to require detailed commitments to mitigation for “long-term” plans.¹⁹⁰ Specific activities are subject to subsequent evaluations, tiered to the plan, and “exact application of mitigation measures will be determined on a site-specific basis.”¹⁹¹ Once again, tiering helped rescue a/m-lite.

Though adaptive management, in and of itself, does not trigger an EIS,¹⁹² adaptive management is not an alternative to NEPA.¹⁹³ A district court relied (in part) on NEPA itself to reject a 2005 rule substituting adaptive management for preparing EISs in developing national forest plans.¹⁹⁴ The court found that the administrative record failed to support a judgment that substituting adaptive management would result in no significant environmental outcomes.¹⁹⁵

C. PROCEDURES FOR ADAPTATION CANNOT SUBSTITUTE FOR SHOWING COMPLIANCE WITH SUBSTANTIVE STANDARDS

Another temptation of adaptive management is to lavish attention on the iterative process at the expense of addressing the substantive management criteria required by law.¹⁹⁶ Courts are particularly attentive to substantive management criteria

187. *Id.* at *14 (citing 40 C.F.R. § 1500.1 (b)).

188. *High Sierra Hikers Ass'n*, 521 F. Supp. 2d at 1072, 1090.

189. *Theodore Roosevelt Conservation P'ship*, 2010 WL 2869778, at *3–4.

190. *Id.* at *16.

191. *Id.* at *15.

192. *See* *Env'tl. Prot. Info. Ctr. v. U.S. Fish & Wildlife Serv.*, No. C 04-04647 CRB, 2005 WL 3021939, at *6 (N.D. Cal. Nov. 10, 2005).

193. *See* Julie Thrower, *Adaptive Management and NEPA: How a Nonequilibrium View of Ecosystems Mandates Flexible Regulation*, 33 *ECOLOGY L.Q.* 871, 894 (2006).

194. *Citizens for Better Forestry v. U.S. Dept. of Agric.*, 481 F. Supp. 2d 1059, 1086–87 (N.D. Cal. 2007).

195. *Id.* at 1089–90.

196. *See* Wiersema, *supra* note 4, at 1256 (arguing that adaptive management by agencies pays insufficient attention to substantive goals).

in statutes, such as the “no jeopardy” standard in the ESA,¹⁹⁷ and regulations, such as the “viability” standard for animal populations in national forests.¹⁹⁸ Since the 1970s, courts have required agencies to develop records showing how they will meet substantive standards.¹⁹⁹ The first round of litigation over adaptive management reveals that courts are holding firm to this principle. Promises to plan, collaborate, or manage toward compliance should environmental conditions degrade below the substantive management criterion are insufficient to survive judicial review.²⁰⁰

197. The “no jeopardy” standard explains that each federal agency must ensure that its actions “are not likely to jeopardize” any endangered species or habitats. 16 U.S.C. § 1536(a)(2) (2006). Courts are often attentive to the “no jeopardy” standard. *See Nat’l Ass’n of Home Builders v. Defenders of Wildlife*, 551 U.S. 644, 669 (2007) (“[N]o-jeopardy duty covers only discretionary agency actions and does not attach to actions (like the NPDES permitting transfer authorization) that an agency is *required* by statute to undertake once certain specified triggering events have occurred.”); *Gifford Pinchot Task Force v. U.S. Fish & Wildlife Serv.*, 378 F.3d 1059, 1067 (9th Cir. 2004) (“Because the ESA does not prescribe how the jeopardy prong is to be determined, nor how species populations are to be estimated, we hold that it is a permissible interpretation of the statute to rest the jeopardy analysis on a habitat proxy.”); *Pac. Coast Fed’n of Fishermen’s Ass’ns v. Gutierrez*, 606 F. Supp. 2d 1122, 1167 (E.D. Cal. 2008) (“[A] jeopardy regulation . . . requires . . . agencies to consider both recovery and survival impacts on listed species.” (citing *Nat’l Wildlife Fed’n v. Nat’l Marines Fisheries Serv.*, 481 F.3d 1224, 1237 (9th Cir. 2007))).

198. The “viability standard” is embodied in 36 C.F.R. § 219.19 (2000) (“In order to insure that viable populations [of fish and wildlife] will be maintained, habitat must be provided to support, at least, a minimum number of reproductive individuals and that habitat must be well distributed so that those individuals can interact with others in the planning area.”). Although formally revoked by National Forest System Land and Resource Management Planning, 65 Fed. Reg. 67,514 (Nov. 9, 2000), that replaced it with a less specific “sustainability” standard, the “viability” standard remained in place for forest planning through most of the Bush Administration. *See, e.g., Native Ecosystems Council v. U.S. Forest Serv.*, 428 F.3d 1233, 1237 n.5 (9th Cir. 2005) (“[A]pplication of these [new] regulations was delayed As a result, the regulations relevant [in the case at bar] are found in the July 1, 2000 Code of Federal Regulations.”).

199. *See, e.g., Citizens to Preserve Overton Park v. Volpe*, 401 U.S. 402, 419 (1971) (affirming the Administrative Procedure Act’s, 5 U.S.C. § 706 (2006), requirement that courts review agency decisions based on the agency’s “whole record”).

200. *See, e.g., Natural Res. Def. Council v. Kempthorne*, 506 F. Supp. 2d 322, 387 (E.D. Cal. 2007) (“Adaptive management is within the agency’s discretion to choose and employ, however, the absence of any definite, certain, or enforceable criteria or standards make its use arbitrary and capricious under the totality of the circumstances.”); *Nat’l Wildlife Fed’n v. U.S. Army Corps of Eng’rs*, 92 F. Supp. 2d 1072, 1078, (D. Or. 2001) (explaining that the Army Corps’ adaptive management approach provided the court with insufficient information to rule on summary judgment); *Fund for Animals v. Babbitt*, 903

The ESA is a prevalent vehicle for placing substantive management criteria on otherwise discretionary management of public lands and waters. The listing of a species often triggers new restrictions on longstanding management regimes, such as water allocations (for example in California's Sacramento Delta)²⁰¹ or timber harvests (for example in the Pacific Northwest).²⁰² The ESA, therefore, often drives adaptive management plans to substitute for older ways of using public resources. Once a management issue triggers ESA compliance, the biological opinion of the Fish & Wildlife or Fisheries Service will essentially establish the boundaries for permissible management options.²⁰³ The biological opinions determine which actions will cross the line into jeopardizing the continued existence of a species, and what measures will be required to protect an agency from liability under the ESA. The litigation reveals that it is these biological opinions that often prompt agency adaptive management.²⁰⁴

F. Supp. 2d 96, 113 (D.D.C. 1995) (holding that a FWS management plan for grizzly bears, which included adaptive management among other schemes, did not meet ESA requirements because "[d]efendants have not met their burden to develop objective, measurable criteria by which to assess present or threatened destruction, modification or curtailment of the grizzly bear's habitat or range"). *But cf.* *Or. Natural Res. Council Action v. U.S. Forest Serv.*, 59 F. Supp. 2d 1085, 1096 (W.D. Wash. 1999) ("The plan's adaptive management approach is adequate to deal with any new information plaintiffs have identified.").

201. *Cent. Delta Water Agency v. U.S. Fish & Wildlife Serv.*, 653 F. Supp. 2d 1066, 1093 (E.D. Cal. 2009) (describing the effects of the decision to list smelt on the water management plan).

202. *Seattle Audubon Soc'y v. Moseley*, 80 F.3d 1401, 1404 (9th Cir. 1996) (per curiam) (noting the effect of listing the spotted owl on the existing forest management plan). *See generally* YAFFEE, *supra* note 108 (describing the history of the listing decision for the spotted owl and its ramifications with respect to politics and environmental regulations).

203. This is particularly true after the action agency has adopted the conditions of the biological opinion. *See* *Delta Smelt Consol. Cases*, 686 F. Supp. 2d 1026, 1043–44 (E.D. Cal. 2009) ("The adaptive management protocol prescribed . . . leaves FWS with the final word on exactly what flow requirements will be imposed.").

204. *See, e.g., In re Operation of the Mo. River Sys. Litig.*, 421 F.3d 618, 626 (8th Cir. 2005) ("The 2000 BiOp RPA also mandated habitat restoration, a comprehensive species and habitat monitoring program, and an adaptive management framework."); *Consol. Salmonid Cases*, 688 F. Supp. 2d 1013, 1025 (E.D. Cal. 2010) ("[In the] 2008 Smelt BiOp . . . the adaptive management protocol [was] prescribed in the RPA."); *Pac. Coast Fed'n of Fishermen's Ass'ns v. Gutierrez*, 606 F. Supp. 2d 1122, 1128 (E.D. Cal. 2008) ("The BiOp was intended to address the potential adverse impacts of ongoing (for the next twenty-five years) CVP and SWP operations on the salmonid species."); *id.* at 1184–85 (discussing the biological opinion's impact on adaptive management).

A pair of decisions by U.S. District Court Judge Oliver Wanger in the Eastern District of California provides a particularly illuminating contrast in the relationship between adaptive management and substantive legal standards.²⁰⁵ Both cases concerned challenges to adaptive management plans for operating the vast water infrastructure that moves water through and around the Sacramento-San Joaquin River Delta in California. The listing of the Delta smelt by the FWS and salmonid species by the Fisheries Service triggered two different biological opinions in order to fulfill the legal duty not to jeopardize the continued existence of the fishes under the ESA. The water project consulted separately with the two services. This gave rise to two sets of adaptive management plans (one for the smelt and one for the salmonids) that generated two different lawsuits.

Both plans employed adaptive management, but Judge Wanger upheld one and remanded the other under the usual judicial standard that an agency must provide “reasonable certainty” that it will meet a statutory requirement.²⁰⁶ The explanation for these disparate results hinges on whether the adaptive management framework offered more than mere process. The salmonid adaptive management protocol, approved by Judge Wanger, contained definite, substantive criteria that served as triggers for reinitiating ESA consultation to revise management.²⁰⁷ Also, the Fisheries Service’s biological opinion imposed “enforceable definite and certain requirements” on the operation of the water works.²⁰⁸ In contrast, the smelt adaptive management protocol failed to provide enforceable, precise criteria to bind operators of the system.²⁰⁹ The adaptive manage-

205. Compare *Pac. Coast Fed’n of Fishermen’s Ass’ns*, 606 F. Supp. 2d at 1194 (remanding the case, but upholding the adaptive management plan), with *Natural Res. Def. Council*, 506 F. Supp. 2d at 387 (remanding the adaptive management plan).

206. See *Pac. Coast Fed’n of Fishermen’s Ass’ns*, 606 F. Supp. 2d at 1184; *Natural Res. Def. Council*, 506 F. Supp. 2d at 353.

207. *Pac. Coast Fed’n of Fishermen’s Ass’ns*, 606 F. Supp. 2d at 1186 (establishing a temperature trigger of fifty-six degrees to reinitiate consultation). Judge Wanger subsequently remanded a later salmonid biological opinion for an arbitrary and capricious formulation of water flow restrictions. See *Consol. Salmonid Cases*, No. 1:09-cv-01053-OWW-DLB, at *5 (E.D. Cal. May 18, 2010) (Finding of Fact and Conclusions of Law Re: Plaintiffs’ Request for Preliminary Injunction), available at <http://www.endangeredspecieslawandpolicy.com/uploads/file/Salmon%20PI.pdf>.

208. *Pac. Coast Fed’n of Fishermen’s Ass’ns*, 606 F. Supp. 2d at 1185 (imposing mandatory terms and conditions as part of an incidental take statement).

209. *Id.* (comparing cases).

ment protocol for the smelt did not bind the operators, but it was procedurally elaborate. It involved a complex “risk assessment matrix” containing criteria that, if met, would trigger a working group to meet.²¹⁰ The group would then “consider” a range of management changes.²¹¹ While the process itself was mandatory, the court faulted the protocol for failing to assure that the result of the process would be some kind of action taken to secure the continued existence of the smelt.²¹² Judge Wanger did not assert that the agency meant to disregard its statutory responsibilities, just that the record of decision failed to ensure that they would be met.²¹³

In overturning the smelt adaptive management protocol, the court contrasted another ESA case addressing a large-scale HCP that would allow land development in the Natomas Basin of the Sacramento area to proceed notwithstanding harms to listed species.²¹⁴ The Natomas Basin HCP employed adaptive management to deal with the uncertainty of where and when development would occur (as well as how effective mitigation measures would conserve the effected species).²¹⁵ Judge Wanger distinguished the adaptive adjustment in the Natomas Basin plan as “employ[ing] *well-defined* mitigation measures” such as conservation land purchases, adjustment of conservation re-

210. *Natural Res. Def. Council*, 506 F. Supp. 2d at 341.

211. *Id.*

212. *See id.* at 352.

213. *See id.* at 354.

214. *Nat'l Wildlife Fed'n v. Babbitt*, 128 F. Supp. 2d 1274 (E.D. Cal. 2000) (endorsing the adaptive management elements of the HCP/incidental take permit while overturning it on a variety of other grounds related to the misfit between the scale of the plan and the governance/commitment of the program).

215. A subsequent case overturning a HCP found that long-term take permits under the ESA require some procedure to deal with unforeseen circumstances. *See Sw. Ctr. for Biological Diversity v. Bartel*, 470 F. Supp. 2d 1118, 1145 (S.D. Cal. 2006). The court relied, in part, on *National Wildlife Federation* to show that adaptive management may fulfill that necessary role. *See id.* at 1144. The origin of the requirement to address unforeseen circumstances is in the original HCP dealing with development of San Bruno Mountain, which the House Conference Report endorsed with legislation that ultimately authorized incidental take permits. *See* ENDANGERED SPECIES ACT AMENDMENTS OF 1982, H.R. REP. NO. 97-835, at 31–32 (1982), *reprinted in* 1982 U.S.C.C.A.N. 2860, 2872–73. Courts now routinely approve HCPs that rely on adaptive management. *See, e.g., Ctr. for Biological Diversity v. U.S. Fish & Wildlife Serv.*, 202 F. Supp. 2d 594, 598 (W.D. Tex. 2002) (upholding a conservation plan, which included adaptive management, because it was “negotiated and regulated vigorously” by the FWS).

serve size, and modification of agricultural practices.²¹⁶ He also distinguished the Natomas Basin plan for its quantified objectives and required mitigation measures, even though those elements could be adjusted.²¹⁷ These substantive distinctions allowed Judge Wanger to distinguish the Natomas Basin plan, which was actually more vaguely drawn than the smelt adaptive matrix.

The pair of Wanger opinions are important for two reasons. First, they likely contain the most thorough judicial discussion to date of adaptive management's strengths and weaknesses. They recognize a role for adaptive management within administrative law, allowing a "balance" between "flexibility" (adaptive management) and "certainty" (final agency action).²¹⁸ This is the fundamental trade-off that courts will continue to mediate in future adaptive management cases. Second, the opinions are important because they draw a line illustrated by two concrete examples, one on the legal side (salmonids) and one on the illegal side (smelt). This comparison is particularly significant because the smelt adaptive management protocol was not at all vague. It was far more detailed than most a/m-lite plans. Yet, when held against a substantive legal standard, the court could not find the "reasonable certainty" of compliance.²¹⁹

It is not surprising that the ESA, with its famously uncompromising mandate,²²⁰ would establish a boundary limiting

216. See *Natural Res. Def. Council*, 506 F. Supp. 2d at 355–56 (emphasis added).

217. *Id.* at 356. In contrast, *Animal Welfare Institute v. Beech Ridge Energy*, 675 F. Supp. 2d 540 (D. Md. 2009), enjoined construction of a ridge-top, wind turbine project because of the likely harm to endangered Indiana bats. In language reminiscent of the smelt biological opinion, the state permit required the energy company to "consult" with a technical advisory committee regarding the "potential for adaptive management" and agree to "test adaptive management strategies." *Id.* at 556. The court found the adaptive management scheme too discretionary to overcome the need for an incidental take permit for the bats likely to be harmed. *Id.* at 579.

218. *Pacific Coast Fed'n of Fishermen's Ass'ns v. Gutierrez*, 606 F. Supp. 2d 1122, 1188 (E.D. Cal. 2008).

219. *Id.*; see also *Greater Yellowstone Coal v. Servheen*, 672 F. Supp. 2d 1105, 1116 (D. Mont. 2009) (holding that a commitment to future monitoring of the agency designation for grizzly bear populations could not substitute for substantive findings required in the statute).

220. *Tenn. Valley Auth. v. Hill*, 437 U.S. 153, 184, 194–95 (1978) (noting that the ESA intends to "halt and reverse the trend toward species extinction, whatever the cost," and thereby strikes a balance "in favor of affording endangered species the highest of priorities").

weak forms of a/m-lite.²²¹ However, several other types of cases find that adaptive management fails to meet substantive criteria of agency law and policy. Agencies employing adaptive management to sustain FONSI's justifying a decision not to prepare an EIS have seen their efforts overturned by courts unconvinced that vague, a/m-lite will assure that the impacts of a project will not be significant.²²² In this respect, a/m-lite may be better suited to an EIS where mitigation need only be discussed, not assured, than to mitigated FONSI's, which must create a record of decision demonstrating (generally through the mitigation measures) the absence of significant impacts.²²³ The mitigation in the record of decision subsequently binds agency action, unlike a mitigation discussion in an EIS, which an agency need not implement.

However, it is possible for an agency to fail to provide enough detail about mitigation under the more flexible standards of an EIS. Mitigation as open-ended contingency planning is not unique to adaptive management. The Ninth Circuit recently found the Bureau of Land Management's (BLM) Final EIS for expansion of a gold mine in Nevada to be inadequate because it failed to assess the effectiveness of mitigation proposed to address possible hydrologic impacts from mine dewa-

221. An early case grappling with adaptive management's role in meeting substantive legal standards is *Oregon Natural Resources Council v. Daley*, 6 F. Supp. 2d 1139, 1158 (D. Or. 1998), which rejected Oregon's habitat restoration program that included watershed councils, monitoring, and adaptive management, as the basis for not listing coho salmon runs. The court found the program to consist of insufficiently certain "future, voluntary and untested habitat measures." *Id.* at 1159.

222. *E.g.*, *Natural Res. Def. Council v. U.S. Army Corps of Eng'rs*, 457 F. Supp. 2d 198, 234 (S.D.N.Y. 2006) (acknowledging that adaptive management practices "provide no assurance as to the efficacy of mitigation"); *Mountaineers v. U.S. Forest Serv.*, 445 F. Supp. 2d 1235, 1250 (W.D. Wash. 2006) ("[A]daptive management strategies . . . amount . . . to a build-first, study later approach . . . [which is a] violation of NEPA." (internal quotations omitted)).

223. Two recent, very deferential decisions from Judge Leon illustrate how nebulously described adaptive management may support EIS mitigation. *See, e.g.*, *Defenders of Wildlife v. Salazar*, 698 F. Supp. 2d 141, 147-48 (D.D.C. 2010) (upholding an elk management plan with little detail on mitigation measures to reduce harms of winter elk concentrations); *Theodore Roosevelt Conservation P'ship v. Salazar*, 605 F. Supp. 2d 263, 279 (D.D.C. 2009) (citing *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 351-52 (1989)) (noting that adaptive management fulfills the EIS mitigation requirement, which only requires discussion of possible measures, not assurance that they will occur), *aff'd*, No. 09-5162, 2010 WL 2869778 (D.C. Cir. July 23, 2010).

tering.²²⁴ Without an assessment of effectiveness, the court determined that mitigation cannot fulfill its purpose as described by the Supreme Court; specifically, to evaluate whether anticipated environmental impacts can be avoided.²²⁵ In this case, the EIS described a monitoring regime and indicated that, if the monitoring showed mitigation measures were necessary, then the mining company would prepare a “detailed, site-specific plan to enhance or replace the impacted perennial water resources.”²²⁶ The absence of detail about the tools employed in such a plan, or on when exactly the plan would be triggered, is common in EISs employing adaptive management to defer some decisions to a later date. Recent draft guidance from the Council on Environmental Quality (CEQ) aims to improve NEPA mitigation by urging agencies to include more specific descriptions of mitigation measures (especially measurable performance standards) and to ensure that mitigation is carried out.²²⁷ Both of these suggestions would significantly improve federal adaptive management, which the CEQ recommends, “in order to minimize the possibility of mitigation failure.”²²⁸

Outside of NEPA, environmental laws frequently impose substantive standards on agencies that cannot be eluded through adaptive management. For instance, a federal district court found that an adaptive management approach to improving storm water phosphorus abatement did not fulfill the legal requirements of the Clean Water Act, which demand that specific effluent limitations be met.²²⁹ Even the public land organic acts, which grant broad discretion to agencies, including the latitude to manage adaptively, sometimes provide standards

224. *S. Fork Band Council v. U.S. Dep’t of the Interior*, 588 F.3d 718, 727 (9th Cir. 2009) (per curiam).

225. *Id.* (internal citation omitted).

226. U.S. DEP’T OF THE INTERIOR: BUREAU OF LAND MGMT., CORTEZ HILLS EXPANSION PROJECT: FINAL EIS § 3.2, at 111 (2008), available at http://blm.gov/nv/st/en/fo/battle_mountain_field/blm_information/national_environmental/cortez_hills_expansion.html.

227. See Memorandum from Nancy H. Sutley, Chair, Council on Env’tl. Quality on Draft Guidance for NEPA Mitigation & Monitoring, 3 (Feb. 18, 2010), available at http://ceq.hss.doe.gov/nepa/regs/Mitigation_and_Monitoring_Draft_NEPA_Guidance_Final_02182010.pdf.

228. *Id.* at 4.

229. See *Miccosukee Tribe of Indians v. United States*, No. 04-21448, 2010 WL 1506267, at *8 (S.D. Fla. Apr. 14, 2010).

that a/m-lite fails to meet.²³⁰ Agencies run the risk of relying on adaptive management as an alternative to the harder work of showing how their plans will meet the substantive legal criteria for their land systems.

Moreover, the focus on adaptive management in public land planning may distract agencies from the hard work of establishing substantive objectives that translate statutory and regulatory goals into place-based standards.²³¹ Richard L. Schroeder's recent study of the comprehensive conservation plans that each unit of the National Wildlife Refuge System must prepare under its organic legislation, revealed that the biological objectives, a key element of the plans required under implementing policy, seldom meet even two of the five criteria in the FWS handbook.²³² The handbook requires each biological objective to be: "(1) Specific, (2) Measurable, (3) Achievable, (4) Results-oriented, and (5) Time-fixed."²³³ Schroeder describes the problem with the plans' neglect of substantive benchmarks:

If [the FWS] is to be able to manage in a manner consistent with the plans, and to practice adaptive management by monitoring progress, then the biological objectives in the plan must be specific

230. *E.g.*, *Klamath Siskiyou Wildlands Ctr. v. Boody*, 468 F.3d 549, 558–59 (9th Cir. 2006) (arguing that adaptive management modifications contemplated in a resource management plan do not shield subsequent management changes from complying with regulations setting out criteria for amending plans); *Greater Yellowstone Coal. v. Kempthorne*, 577 F. Supp. 2d 183, 195 (D.D.C. 2008) (stating that an adaptive management plan for snowmobiles "provides no quantitative standard or qualitative analysis to support" a conclusion of no impairment under the park system Organic Act); *High Sierra Hikers Ass'n v. Weingardt*, 521 F. Supp. 2d 1065, 1091 (N.D. Cal. 2007) (illustrating that an agency may not rely on adaptive management to avoid a showing in the administrative record that it will meet the standards of the Wilderness Act).

231. *See* Refuge Planning Policy Pursuant to the National Wildlife Refuge System Administration Act as Amended by the National Wildlife Refuge System Improvement Act of 1997, 65 Fed. Reg. 33,892, 33,906 (May 25, 2000) (stating that one of the eight goals of unit-level planning is "[to] provide a basis for adaptive management by monitoring progress, evaluating plan implementation, and updating refuge plans accordingly"). Substantive statutory goals for refuges include ensuring "that the biological integrity, diversity, and environmental health of the System are maintained," 16 U.S.C. § 668dd(a)(4)(B) (2006), and sustaining "healthy populations of fish, wildlife, and plants," 16 U.S.C. §§ 668dd(a)(4)(D)–668ee.

232. *See* Richard L. Schroeder, *Evaluating the Quality of Biological Objectives for Conservation Planning in the National Wildlife Refuge System*, 26 GEO. WRIGHT F. 22, 25 (2009).

233. *Id.* at 23 (quoting ROBERT S. ADAMCIK ET AL., U.S. FISH & WILDLIFE SERV., WRITING REFUGE MANAGEMENT GOALS AND OBJECTIVES: A HANDBOOK 8 (2004)).

and measurable, as recognized by [the FWS's] own policy. If the objectives lack specificity and detail, as the majority do, then [the FWS] will be unable to measure progress toward their achievement, and thus, will be unable to know if they are indeed managing refuge lands in a manner consistent with the plans.²³⁴

In their haste to complete plans and to describe adaptive management procedures, agencies too often neglect the establishment of site-specific standards for measuring compliance with statutory or regulatory criteria.

III. LESSONS FOR THE NEXT GENERATION OF ADAPTIVE MANAGEMENT

The picture that emerges from the first round of litigation over adaptive management should not surprise observers of conservation conflicts. One reason the ambitions expressed in law and policy exceed the abilities of agencies to implement is inadequate funding.²³⁵ Agencies attempt to maximize their discretion and minimize their exposure to political controversy from unpopular decisions.²³⁶ Interest groups, including environmentalists, seek to lock in promises through binding commitments early in the management process.²³⁷ Courts are attentive to substantive management standards in reviewing agency records for compliance with the law. Most environmental managers and stakeholders approve of adaptive management in theory; disagreements focus on application in practice.²³⁸ Courts cannot directly distinguish legitimate adaptive management from imposters.²³⁹ But in policing compliance with administrative and environmental law, courts can unmask some of the most egregious failures to incorporate the key elements necessary for structured learning during the course of a project, which often get sidelined in the rough and tumble of implementation.²⁴⁰ Given the limitations of the judicial role, we now offer some lessons for agencies and Congress for further improvement of adaptive management in practice.

234. *Id.* at 27.

235. *See supra* note 68 and accompanying text.

236. *See Doremus, supra* note 4, at 56.

237. *Id.* at 85.

238. *See* Fred Johnson, *Protocol and Practice in the Adaptive Management of Waterfowl Harvests*, 3 CONSERVATION ECOLOGY 8 (June 30, 1999), <http://www.ecologyandsociety.org/vol3/iss1/art8/>.

239. *See* Gregory et al., *supra* note 72, at 2424.

240. *See id.*; Doremus, *supra* note 1, at 569–70.

A. LESSONS FOR AGENCIES

Our research confirms the intuition that adaptive management is one of the most difficult tasks for agencies attempting comprehensive ecosystem stewardship.²⁴¹ However, the impression in agencies that lawsuits and appeals present a barrier to implementing adaptive management²⁴² is unfounded. When agencies lose challenges to their adaptive management plans, it is often because their preference for management latitude runs afoul of the need to show they can meet substantive and procedural standards in statutes, regulations, or even their own earlier plans. Several strategies can help agencies avoid that pitfall.

1. Shoring Up a/m-lite in Substance

In order to wring the most benefits from a/m-lite, agencies should strive to do their best to create plans that include as many of the elements of adaptive management theory as possible, especially designing management actions as experiments so that they promote learning to reduce uncertainty. However, this crucial element of adaptive management is not generally required by law and courts will not impose it.²⁴³ More structured learning would improve a/m-lite by capturing more benefits of adaptive management theory. This reform will need strong prompting from Congress, agency leadership, and administrative guidance. The courts will, however, impose some discipline on the use of a/m-lite.

The lessons for an agency embarking on a/m-lite require it to restrain its enthusiasm for discretion: the plan must be as detailed as practical. The more vague the a/m-lite, the more likely that a court will find it inadequate.²⁴⁴ Criteria for measuring success and triggering contingency actions must be clearly articulated in the record of decision.²⁴⁵ Agencies should commit to monitoring the key criteria and should employ their

241. Tomas M. Koontz & Jennifer Bodine, *Implementing Ecosystem Management in Public Agencies: Lessons from the U.S. Bureau of Land Management and the Forest Service*, 22 CONSERVATION BIOLOGY 60, 60 (2008).

242. *Id.* at 65–66.

243. *See* *Lands Council v. McNair*, 537 F.3d 981, 988 (9th Cir. 2008) (refusing to take a close look at whether the agency adaptively learned from previous logging before undertaking another, similar logging project).

244. *See supra* text accompanying note 180.

245. *See supra* text accompanying notes 176–80.

data when revising or expanding projects.²⁴⁶ Most important, adaptive management must have direction—it needs to deploy its procedural tools to home in on specific goals.

Related to this lesson is that adaptive management cannot substitute for a showing of reasonable certainty that substantive criteria will be met. The pageantry of procedures and flow charts may distract agencies from their mandates to achieve specific environmental objectives. Agencies should resist looking at adaptive management as a short cut around the difficult task of compiling a record that substantiates claims about such key tests as viability, nonimpairment, or no jeopardy. Adaptive plans, to be effective, must translate the substantive standards of statutes, rules, and manuals into place-based objectives.

2. Improving a/m-lite as Procedure

While substantive standards, where they exist, helpfully constrain and focus adaptive management, there is also a set of lessons for agencies involving the procedural charter established by NEPA, which requires all federal agencies to prepare an EIS for “major Federal actions significantly affecting the quality of the human environment.”²⁴⁷ Indeed, as the origins of adaptive management are found in Holling’s critique of conventional environmental impact analysis, it is fitting that NEPA recently has been the subject of much thinking about how to promote adaptive management. In 1997, for example, the CEQ echoed Holling’s assessment that under the traditional NEPA model “adequate environmental protection depends solely on the accuracy of the predicted impacts and expected mitigation results” and that NEPA should be reoriented around “[a]daptive environmental management.”²⁴⁸ Building on that theme, the 2003 NEPA Task Force Report, *Modernizing NEPA Implementation*, contained a full chapter devoted to “[a]daptive [m]anagement and [m]onitoring,”²⁴⁹ the gist of which was to use NEPA to help move federal agencies from the “predict-

246. See *supra* text accompanying note 138.

247. 42 U.S.C. § 4332(2)(C) (2006).

248. COUNCIL ON ENVTL. QUALITY, EXEC. OFFICE OF THE PRESIDENT, THE NATIONAL ENVIRONMENTAL POLICY ACT: A STUDY OF ITS EFFECTIVENESS AFTER TWENTY-FIVE YEARS 32 (1997).

249. NEPA TASK FORCE, REPORT TO THE COUNCIL ON ENVIRONMENTAL QUALITY: MODERNIZING NEPA IMPLEMENTATION 44 (2003).

mitigate-implement” model to the “predict-mitigate-implement-monitor-adapt” model.²⁵⁰

NEPA, of course, imposes no enforceable substantive duties on federal agencies and thus cannot mandate adaptive management.²⁵¹ Moreover, environmental impact analysis performed under NEPA assumes the conventional front-end comprehensive predecisional form, so it cannot incorporate adaptive management as an assessment tool per se.²⁵² But, the NEPA Task Force identified two avenues in which adaptive management and NEPA can usefully intersect in ways consistent with our evaluation of the adaptive management case law presented in Part II.

First, federal agency actions that employ adaptive management may be in a position to reduce the need for new or supplemental NEPA analyses when changed conditions require changes in resource management.²⁵³ This is one of the lessons manifest in the litigation over the NWFP.²⁵⁴ Second, federal actions that employ adaptive management may be in a better position to argue that mitigation measures incorporated in the federal action and put into effect through adaptive management justify the decision not to prepare a full EIS (i.e., to mitigate to a finding of no significant impact, or FONSI).²⁵⁵ Our review of adaptive management litigation bolsters this claim by the CEQ only in circumstances where there is an earlier, comprehensive EIS to which the Environmental Assessment tiers.²⁵⁶

250. *Id.* at 45.

251. The Supreme Court’s oft-repeated observation is that while “NEPA does set forth significant substantive goals for the Nation[,] . . . its mandate to the agencies is essentially procedural.” *Vt. Yankee Nuclear Power Corp. v. Natural Res. Def. Council, Inc.*, 435 U.S. 519, 558 (1978); *see also* *Stryker’s Bay Neighborhood Council, Inc. v. Karlen*, 444 U.S. 223, 227 (1980) (per curiam) (stating that once an agency has complied with NEPA procedures, the courts do not question the choice of action the agency has taken).

252. Agencies must prepare the EIS prior to deciding which action to select, and there is no need for subsequent monitoring and assessment to follow up on the EIS after the agency action has been selected and implemented. *See* David R. Hodas, *NEPA, Ecosystem Management and Environmental Accounting*, 14 NAT. RESOURCES & ENV’T 185, 188 (2000) (describing NEPA’s lack of post-EIS review as inadequate to support ecosystem management).

253. *See* NEPA TASK FORCE, *supra* note 249, at 47.

254. *See supra* text accompanying note 166.

255. *See* NEPA TASK FORCE, *supra* note 249, at 48.

256. *See supra* text accompanying notes 222–27.

Hence, whereas the traditional NEPA model provides no incentive to federal agencies (or the state, local, and private entities sponsoring the projects federal agencies fund or authorize) to incorporate adaptive management in the actions being evaluated under NEPA, the Task Force used the prospect of avoiding having to prepare a full or supplemental EIS as an incentive to do just that. Indeed, in 2007 the Forest Service proposed rules to update its procedures for NEPA compliance with numerous references to adaptive management built around the provision that

[a] proposed action or alternative(s) may include adaptive management strategies allowing for adjustment of the action during implementation. If the adjustments to an action are clearly articulated and pre-specified in the description of the alternative and fully analyzed, then the action may be adjusted during implementation without the need for further analysis.²⁵⁷

Similarly, in 2008 the DOI proposed revisions to its NEPA implementation rules directing that “[b]ureaus should use adaptive management as part of their decisionmaking processes, as appropriate, particularly in circumstances where long-term impacts may be uncertain and future monitoring will be needed to make necessary adjustments in subsequent implementation decisions.”²⁵⁸

Another theme of NEPA reformers consistent with the case law on adaptive management has been to encourage more attention to large-scale or programmatic EISs.²⁵⁹ Early-stage analyses can be difficult to perform because activities may still be nebulous. But, early and broad evaluations can steer agencies in more effective and environmentally benign directions.²⁶⁰ They are the analyses most likely to actually help agency decisionmakers. The bigger temporal and geographic scales representing the greatest agency successes in the adaptive management litigation bolster this general argument of NEPA reformers. Because adaptive management is expensive, agencies should place their highest funding priorities on large-scale efforts, which are most likely to yield useful, incremental adjustments over time.²⁶¹

257. National Environmental Policy Act Procedures, 72 Fed. Reg. 45,998, 46,005 (Aug. 16, 2007).

258. Implementation of the National Environmental Policy Act (NEPA) of 1969, 73 Fed. Reg. 126, 135 (Jan. 2, 2008).

259. See, e.g., COUNCIL ON ENVTL. QUALITY, *supra* note 248, at 11–13.

260. See *id.* at 12.

261. See *id.* at 14.

Despite fundamentally different assumptions about knowledge and decisionmaking, adaptive management is compatible with NEPA. Adaptive management is well suited to the NEPA tiering that natural resources agencies already use adeptly. An added incentive for agency use of adaptive management in EISs is that it may raise the threshold for requiring a supplemental EIS should new information emerge. Agencies must be attentive to the obligation that mitigated FONSI demonstrate that impacts will fall below the significance threshold. Adaptive management alone, without substantive triggers, may not shoulder the burden.

3. Extending a/m-lite to Pollution Control

The pollution-control side of environmental litigation has not directly addressed adaptive management. The strong “cooperative federalism” structure of pollution-control law introduces the complications of state implementation that go far beyond the Sacramento-San Joaquin Delta example.²⁶² Pollution control also involves far more regulation of private economic activity than does resource management.²⁶³ But the relatively stronger emphasis on meeting substantive criteria, such as National Ambient Air Quality Standards (NAAQS),²⁶⁴ in pollution-control law will increasingly provide some lessons for implementing adaptive management. For example, the Fifth Circuit upheld the EPA’s approval of a Texas State Implementation Plan (SIP), which the Clean Air Act requires to demonstrate that the state will be able to attain NAAQS.²⁶⁵ The SIP at issue purported to demonstrate that the Houston-Galveston area would comply with the NAAQS for ozone.²⁶⁶ The state was able to devise control measures that would achieve ninety-four percent of the pollution reduction needed to attain the NAAQS.²⁶⁷ In order to extract the additional six per-

262. See Robert L. Fischman, *Cooperative Federalism and Natural Resources Law*, 14 N.Y.U. ENVTL. L.J. 179, 207–29 (2005) (contrasting the versions of cooperative federalism in pollution control and resource management).

263. See Robert L. Fischman, *The Divides of Environmental Law and the Problem of Harm in the Endangered Species Act*, 83 IND. L.J. 661, 663 (2008) (discussing the characteristic differences between pollution control and natural resources law). The ESA is a resource management statute that straddles the divide and does regulate some private activities directly. *Id.* at 684.

264. 42 U.S.C. §§ 7408–7409 (2006).

265. BCCA Appeal Grp. v. U.S. Env’t Prot. Agency, 355 F.3d 817, 821–22 (5th Cir. 2003).

266. *Id.* at 822–23.

267. *Id.* at 838.

cent reduction, the EPA accepted the SIP's "enforceable commitment to adopt and implement additional . . . controls."²⁶⁸ The SIP could not specify what those additional controls would be, but it did provide "a list of soon-to-be-available, cutting-edge technologies."²⁶⁹ The court upheld the EPA determination under the *Chevron* standard of review.²⁷⁰ The Texas SIP case illustrates how pollution control benefits from large-scale plans that promise to meet substantive criteria through thousands of small steps. Texas benefited from the large scale in committing to additional reductions (six percent) without specifying the exact sources of contribution to that goal. The court's deferential standard of review afforded the EPA flexibility to approve the experiment of meeting the standard through as-yet-unavailable technology.²⁷¹ This is a form of narrowing uncertainty over time that is widely viewed as an attribute of adaptive management.

On the other hand, the EPA recently refused to extend its flexibility in proposing to disapprove a Texas SIP revision employing a "Flexible Permits" approach to meet the Clean Air Act's new source review requirements for industrial sources of pollution.²⁷² The Texas program would allow individual sources to exceed standards as long as they provided cumulative emissions reductions on a case-by-case basis.²⁷³ The EPA's proposed finding emphasized that the state program does not meet the statutory standards and fails to ensure accountability, compliance, and monitoring.²⁷⁴ These are familiar criticisms of the a/m-lite plans reviewed in the natural resources litigation.

The EPA recently restructured its Chesapeake Bay Program (CBP) to emphasize adaptive management. The CBP covers a larger area than the Texas SIPs, or even the NWFP. In

268. *Id.* at 839–40.

269. *Id.* at 841.

270. *Id.* at 842.

271. *Id.* at 841.

272. Approval and Promulgation of Implementation Plans, 74 Fed. Reg. 48,480, 48,480 (Sept. 23, 2009). New source review provides for the "regulation of the modification and construction" of certain stationary sources of air pollution. 42 U.S.C. § 7410(a)(2)(C) (2006).

273. Approval and Promulgation of Implementation Plans, 74 Fed. Reg. at 48,485–86.

274. *See id.* at 48,482. This is consistent with the *Miccosukee Tribe* rejection of adaptive, incremental improvement through best technology in lieu of strictly imposed water-quality based, storm-water effluent limitations for phosphorus in order to meet Clean Water Act substantive requirements. *See Miccosukee Tribe of Indians v. United States*, No. 04-21448, 2010 WL 1506267, at *8 (S.D. Fla. Apr. 14, 2010).

response to a 2007 congressional mandate, the EPA revised its CBP around four basic components, one of which is adaptive management.²⁷⁵ In 2009, President Obama ordered the EPA to work with other federal agencies to implement adaptive management in the CBP.²⁷⁶ However, in contrast to the SIPs, the CBP has few enforceable criteria (but many quantitative goals) and its multistate dimension tends to create adaptive management plans focused primarily on the process of coordination.²⁷⁷ With diffuse responsibility, an emphasis on monitoring and study, and few interim targets, the new CBP has already received criticism as a helpless giant.²⁷⁸ Nonetheless, we expect increased use of adaptive management in adjusting water quality standards and total maximum daily loads of pollutants for impaired bodies of water, such as the Chesapeake Bay.

4. Public and Industry Buy-In

The courts are not the only institution reviewing adaptive management. Private regulated interests have expressed concerns about the capacity of adaptive management to add continually to the conditions imposed by resource development authorizations without the security of finality. The Army Corps, for example, heard this complaint as it developed adaptive management provisions in the new wetlands compensatory mitigation rule:

275. U.S. ENVTL. PROT. AGENCY, CBP/TRS-292-08, STRENGTHENING THE MANAGEMENT, COORDINATION, AND ACCOUNTABILITY OF THE CHESAPEAKE BAY PROGRAM, at ii–iii (2008) [hereinafter CHESAPEAKE BAY PROGRAM], available at http://cap.chesapeakebay.net/docs/EPA_Chesapeake_Bay_CAP.pdf.

276. Chesapeake Bay Protection and Restoration, Exec. Order No. 13,508, 74 Fed. Reg. 23,099, 23,101–03 (May 15, 2009) (directing the EPA in section 301(b) to draft pollution-control strategies that are “based on sound science and reflect adaptive management principles” and noting in section 801 that the DOI is to use “adaptive management to plan, monitor, evaluate, and adjust environmental management actions”).

277. See, e.g., CHESAPEAKE BAY PROGRAM, *supra* note 275, at 26 (listing quantitative goals with adaptive management strategies); *id.* at 34 (providing the CBP management system diagram illustrating a detailed procedural method).

278. See Rena Steinzor & Shana Campbell Jones, *Reauthorizing the Chesapeake Bay Program: Exchanging Promises for Results* 1 (Ctr. for Progressive Reform, Working Paper No. 903, 2009). The detailed management system is reminiscent of the ecosystem management model skewered by Professor Houck for lack of substance and neglect of lawmaking. See Oliver Houck, *On the Law of Biodiversity and Ecosystem Management*, 81 MINN. L. REV. 869, 937–39 (1997) (“Nothing better illustrates the potential benefit and reach of ecosystem management, and its latent danger, than the Inner Columbia Basin story . . .”).

One commenter suggested that if a permittee has made a “good faith effort” to meet performance standards, no additional compensatory mitigation requirements should be imposed other than an extension of the monitoring period. Several commenters said that requiring adaptive management efforts beyond what is currently required as remediation or contingency actions will impose additional financial and resource burdens on mitigation providers.²⁷⁹

The agency’s response was a Solomonic mixed bag. On the one hand, the Army Corps acknowledged the reality that “there may be additional costs associated with an adaptive management approach, but we believe that such an approach is necessary to achieve compensatory mitigation project objectives, or to provide comparable or superior ecological benefits.”²⁸⁰ Yet, the agency did clarify that the scope of adaptive management is not boundless, noting that “adaptive management does not require anticipation of all potential challenges, since that would be impossible to accomplish.”²⁸¹ This is unlikely to be of comfort to regulated interests, however, as it leaves much to the details of the adaptive management plan and subsequent implementation. As we conclude from our case law evaluation, courts may find this approach too open-ended if the plan is not sufficiently detailed to assure substantive compliance.

Just as regulated interests are concerned that adaptive management will lead to runaway land management burdens, environmental protection interests are concerned that it will lead to closed-door resource development approvals. For example, as FWS brought adaptive management on line for the HCP permit program under the ESA,²⁸² environmentalists complained about inadequate access to meaningful public participation in the HCP negotiation process and the lack of an ongoing public role in the implementation of adaptive management over the life of the HCP permit.²⁸³ By the late 1990s, environmental groups had begun to accuse the HCP of making deci-

279. Compensatory Mitigation for Losses of Aquatic Resources, 73 Fed. Reg. 19,594, 19,647 (Apr. 10, 2008).

280. *Id.*

281. *Id.* at 19,620.

282. *See supra* notes 2, 6 and accompanying text.

283. *See, e.g.*, LAURA C. HOOD, FRAYED SAFETY NETS: CONSERVATION PLANNING UNDER THE ENDANGERED SPECIES ACT, at vi–xiii (1998) (presenting a pessimistic assessment of the HCP program); John Kostyack, *Surprise!*, 15 ENVTL. F., Mar.–Apr. 1998, at 19, 19–24 (presenting an extensive criticism of the HCP program from the perspective of an attorney for the National Wildlife Federation); *cf.* Robert D. Thornton, *Habitat Conservation Plans: Frayed Safety Nets or Creative Partnerships?*, 16 NAT. RESOURCES & ENV’T 94, 95–96 (2001) (describing criticism from other organizations).

sions without following “biological standards” and to demand more public participation as a result.²⁸⁴ For example, in 1999 the Defenders of Wildlife issued a blistering critique of the HCP program, complaining that, among other things,

[c]itizens from various stakeholder groups have no formal role in the HCP process except through the public comment period and . . . generally have not had a seat at the negotiating table in many major recent negotiations despite the fact that conservationists (in addition to FWS) represent the public’s interest in protecting endangered species.²⁸⁵

Since then, some HCPs have been found by courts to contain robust adaptive management provisions that detail a comprehensive monitoring and adjustment protocol and specify the kinds of events and responses for which adjustments will be made.²⁸⁶ FWS has also joined other state and federal agencies to develop detailed technical guidance for monitoring protocols to assist adaptive management in large-scale HCPs.²⁸⁷ Yet, public participation of the kind demanded has yet to be made a component of HCP adaptive management implementation. The pressure for more public input on this and other aspects of HCP

284. See, e.g., HOOD, *supra* note 283, at 59–61, 80–81 (summarizing the Defenders of Wildlife’s critique of the HCP program).

285. *Id.* at 41; see also Holly Doremus, *Preserving Citizen Participation in the Era of Reinvention: The Endangered Species Act Example*, 25 *ECOLOGY L.Q.* 707, 712–15 (1999) (examining the growing tension between the HCP and other ESA reform programs and public participation values).

286. For an example, see *Center for Biological Diversity v. U.S. Fish and Wildlife Service*, 202 F. Supp. 2d 594 (W.D. Tex. 2002). This case involved a dispute between plaintiff Center for Biological Diversity environmental group and defendant-intervener La Cantera, a commercial development company, regarding 750 acres of land in Bexar County, Texas. *Id.* at 597. The FWS issued an Incidental Take Permit to La Cantera, and the plaintiff challenged virtually every aspect of the permit, including the adequacy of the adaptive management provisions, but lost on every claim notwithstanding the court’s expressed aversion to allowing development in habitat of endangered species. The court’s discussion of the adaptive management provisions emphasized the comprehensive and detailed nature of the monitoring and response protocols. See *id.* at 616. Seven years later, after reviewing an annual report the court required to be filed each year describing management actions under the permit, the court issued an order congratulating the permittee and agency “for coming to this positive result and a fine example of corporate citizenship.” *Ctr. for Biological Diversity v. U.S. Fish & Wildlife Serv.*, No. SA-01-CA-1139-FB (W.D. Tex. May 5, 2009) (order acknowledging annual report on file with author). In the interest of full disclosure, Professor Ruhl served as a consultant to the HCP applicant in the case.

287. See U.S. DEPT OF THE INTERIOR ET AL., *DESIGNING MONITORING PROGRAMS IN AN ADAPTIVE MANAGEMENT CONTEXT FOR REGIONAL MULTIPLE SPECIES CONSERVATION PLANS* 10–40 (2004), available at <http://www.dfg.ca.gov/habcon/nccp/publications.html>.

permits thus continues to build.²⁸⁸ We expect similar issues to develop in other permitting and approval programs using adaptive management.²⁸⁹

Neither the regulated industry certainty nor the public participation concern has surfaced in claims brought against adaptive management in the courts to date, and no court has expressed concern in either respect *sua sponte*. This probably is due more to the hybrid nature of a/m-lite than it is to the underlying justifications for the respective concerns. Agencies practicing a/m-lite do so against the context of conventional natural resources management laws, which tend not to specify conditions for regulated party certainty and which prescribe fairly minimal public participation in the form of notice and comment. So long as an agency satisfies the black-letter requirements of statutes in these respects, courts are unlikely to nullify use of a/m-lite on these grounds. By the same token, however, the black-letter law also constrains how far agencies can go with a/m-lite, as truly iterative “learning while doing” may at some point run afoul of permitting procedures and criteria, as well as the demands of public notice and comment. Our message to agencies in this respect is not to take the absence of these concerns registering in the case law to date as evidence that there is no limit to how far agencies can implement a/m-lite without regard to regulated industry and public interests. Stretch it too far in either respect and the lawsuits are sure to come.

B. LESSONS FOR CONGRESS

Even if agencies follow the lessons we have extracted from the existing adaptive management case law, which we believe would reduce adverse judicial reaction, the most they could hope for is to be able to implement a disciplined form of a/m-lite. The courts cannot provide the funding necessary to support true “learning while doing,” and neither can they supply more authority or clearer standards than exist in existing statutory text. Only Congress can let agencies break out of the a/m-lite mold without fear of public, industry, and judicial push-

288. For a recent evaluation of the HCP program, including a proposal for more public participation, see David Dana, *Reforming Section 10 and the Habitat Conservation Program* 12–17 (Nw. Univ. School of Law & Econ., Working Paper No. 09-44), available at <http://papers.ssrn.com/abstract=1519515>.

289. For example, the public participation issue confronted the NEPA Task Force as well. See NEPA TASK FORCE, *supra* note 249, at 51.

back. Of course, Congress is not bound to follow the lead the courts have given agencies, but we believe Congress would be well advised to codify judicial guideposts for determining when the practical demands on adaptive management warrant departure from the pristine theory and when, on the other hand, the agencies have given themselves too long a leash.

On the funding question, it is time for Congress to consider supporting adaptive management plans through the purchase of annuities that would ensure a steady stream of subsequent funding for the development of management experiments, monitoring, and revision.²⁹⁰ Current appropriation practice, which provides most funding for the first stage of planning and not for the subsequent iterations, is inadequate to reap significant benefits from adaptive management. Prior efforts, most notably through the Forest and Rangeland Renewable Resources Planning Act of 1974,²⁹¹ failed in disciplining Congress to make strategic investments in resource management.²⁹² The 1974 statute established an elaborate planning regime which viewed forests as capital assets requiring reliable future funding to maintain their value. It required an annual “Statement of Reasons” from the President explaining deviations of proposed budgets from the needed funds projected in long-term plans, but both branches ignored the well-intentioned legislation.²⁹³ Creating endowments or purchasing annuities are more concrete assurances of follow-through and deserve further exploration. This would be a timely project as Congress considers climate change legislation that may provide new revenues from sales of emission allowances.²⁹⁴ In the absence of congressional

290. Examples abound of agencies unable to afford the monitoring described in adaptive plans. A common scenario is national forests unable to fund the monitoring of indicator species populations identified in forest plans. *See, e.g.*, *Lands Council v. McNair*, 537 F.3d 981, 999–1001, 1000 n.12 (9th Cir. 2008); *Utah Env'tl. Cong. v. Bosworth*, 439 F.3d 1184, 1190–97 (10th Cir. 2006); *Sierra Club v. Martin*, 168 F.3d 1, 3–8 (11th Cir. 1999); *Inland Empire Pub. Lands Council v. U.S. Forest Serv.*, 88 F.3d 754, 763–65 (9th Cir. 1996); *see also W. Watersheds Project v. U.S. Forest Serv.*, No. CV-05-189-E-BLW, 2006 WL 292010, at *4–8 (D. Idaho 2006) (identifying inadequate funding for the Forest Service to apply forest plan standards relating to grazing suitability using on-the-ground studies).

291. 16 U.S.C. §§ 1601–1613 (2006).

292. *See Nat'l Wildlife Fed'n v. United States*, 626 F.2d 917, 919–20 (D.C. Cir. 1980); GEORGE C. COGGINS ET AL., *FEDERAL PUBLIC LAND AND RESOURCES LAW* 690 (6th ed. 2007).

293. COGGINS ET AL., *supra* note 292, at 690.

294. *See Glicksman, supra* note 4, at 873. The leading bills in both the House and Senate provide substantial funding for natural resource conservation.

action, agencies should at least use NEPA to disclose funding needs for adaptive management and the environmental effects that would result from failure to find the means for implementation of monitoring, mitigation, or adjustment.²⁹⁵

In addition to reforming the appropriations process, Congress could substantially improve the practice of adaptive management in natural resource administration. It is possible to establish clearer standards to ensure that an agency purporting to employ adaptive management actually does an adequate job. Congress should explicitly require adaptive management plans to (1) clearly articulate measurable goals, (2) identify testable hypotheses (or some other method of structured learning from conceptual models), and (3) state exactly what criteria should apply in evaluating the management experiments. These requirements would address the vast majority of nonbudgetary problems with a/m-lite. With explicit learning goals and established measures of success, agencies could retain discretion to adjust their decisions while offering far greater assurances to stakeholders.

Assuring future funding and requiring that the experimental elements of adaptive management be more precisely defined would address both the disparities we noted at the beginning of Part II.C. of this Article. These elements would provide judicially enforceable benchmarks for oversight of natural resources planning and management. They would also rein in the a/m-lite practices that currently serve as open-ended contingency planning by ensuring that all adaptive management plans get the benefit of the scientific method to guide future iterations. In narrowing the disparities, they would wring more benefits from adaptive management by reducing uncertainty as plans move forward.²⁹⁶ True, adaptive management in practice would remain a somewhat grotesque hybrid of conservation policy's complexity theory and modern administrative law's approach to pluralism and finality. But it would likely achieve more of the benefits we wish to extract from ecosystems with less rancor.

Clean Energy Jobs and American Power Act, S. 1733, 111th Cong. (2009); American Clean Energy and Security Act of 2009, H.R. 2454, 111th Cong. (2009).

295. See Memorandum from Nancy H. Sutley, *supra* note 227, at 4 (recommending disclosure of these needs and effects relating to mitigation); *id.* at 7 (citing U.S. Army NEPA regulations assuring effective mitigation by barring actions until mitigation measures are fully funded or until lack of funding is addressed in the NEPA analysis, 32 C.F.R. § 651.15(a)(5)(d)).

296. Doremus, *supra* note 1, at 569.

The federal government has noted that “[c]limate change creates new situations of added complexity for which an adaptive management approach may be the only way to take management action today while allowing for increased understanding and refinement tomorrow.”²⁹⁷ Commentators agree, and there are currently no viable alternative approaches to respond to the increased uncertainties surrounding conservation.²⁹⁸ Therefore, the stakes are high for public agencies to refine their approach to adaptive management in light of the lessons from the first generation of litigation.

CONCLUSION

Our review of the first generation of adaptive management litigation provides more than an analysis of how the law applies or the reaction of the judiciary. It also opens a window into the actual practices that agencies have justified under the title adaptive management. Not surprisingly, implementation fails to mirror the finely wrought theory of adaptive management. The litigation reflects the practical and political compromises agencies make, whether applying adaptive management or any other model of natural resources management decisionmaking. It highlights how rarely real learning and reduced uncertainty result, and how haphazardly they feed back into agency programs. But it also points the way toward improved implementation and legislative reform.

The next round of lawsuits over adaptive management will likely focus on how well the procedures developed in large-scale plans have fulfilled their promise. Only the NWFP is old enough to have experienced much second-generation litigation. However, agencies should prepare by being careful about what they promise. The temptation to defer difficult and costly analysis, or punt on politically controversial decisions, may create problems for agencies down the line. What might have been a routine implementation project may explode into an expensive, complex task if the initial a/m-lite failed to commit to a course of action, applied only vague criteria for evaluating actions, or deferred substantial analysis of site-specific effects.

297. JILL S. BARON ET AL., PRELIMINARY REVIEW OF ADAPTATION OPTIONS FOR CLIMATE-SENSITIVE ECOSYSTEMS AND RESOURCES 25 (Susan Herrod Julius & Jordan M. West eds., 2008), available at <http://www.climate-science.gov/Library/sap/sap4-4/final-report/#finalreport>.

298. See Glicksman, *supra* note 4, at 871.

One must wonder, however, about how much time we have for lessons to come out of the second generation of adaptive management litigation. The pressure on Congress, agencies, the courts, and all natural resources policy stakeholders to further refine, implement, and work within a regime of adaptive management is not about to let up. There is widespread agreement, for example, that the effects of climate change on natural resources will be complex, dynamic, nonlinear, and frequently unpredictable over anything but short time frames, all of which are conditions that demand adaptive management responses.²⁹⁹ Yet, although the first generation of litigation seems to have laid down some important foundational lessons for this effort, doing so took a span of roughly fifteen years. Adaptive management litigation now risks getting down in the weeds, so to speak, and must avoid letting the perfect be the enemy of the good at a time when decisive action is needed. Our assessment of adaptive management in the courts suggests there is a good model in place. If agencies follow it and courts enforce it faithfully, it may serve as a potent component of climate change policy notwithstanding its flaws.

299. See Camacho, *supra* note 138, at 64 (calling for “an adaptive methodology for assessing and adjusting government decision making over time”); Robin Kundis Craig, “Stationarity Is Dead”—*Long Live Transformation: Five Principles for Climate Change Adaptation Law*, 34 HARV. ENVTL. L. REV. 9, 65–67 (2010) (“Be serious about using adaptive management—and change both natural resources and administrative laws to allow for it.”); Glicksman, *supra* note 4, at 868 (“The land management agencies, in the planning process as well as in other contexts, must *rely heavily* on the management technique known as *adaptive management*.”); J.B. Ruhl, *Climate Change Adaptation and the Structural Transformation of Environmental Law*, 40 ENVTL. L. 363, 416–23 (2010) (discussing greater need for adaptive management to implement climate change adaptation policy). Experts from environmental organizations, such as the Environmental Law Institute’s Carl Bruch, concur in the important role adaptive management will play in climate change policy. See Carl Bruch, *The End of Equilibrium*, ENVTL. F., Sept.–Oct. 2008, at 30, 32 (“Incorporating adaptive management into laws and institutions can enhance the capacity of governance systems and ecosystems to adapt to changing climactic conditions, to develop and deploy new technologies and techniques.”).