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Introduction: Resilience, Law, and Natural Resource Management

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Marilyn Averill*

Introduction: Resilience, Law, and Natural Resource Management

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I. INTRODUCTION

Managing natural resources involves political, cultural, economic, and ecological challenges. Much has been written about the increased stresses posed by a changing global climate, increased population, and accelerating development. How will these stresses affect resources on our public and private lands and waters? What human responses can help both humans and ecosystems to adapt to changing conditions? How can degraded resources be restored? What are the best ways to frame these issues in order to effectively inform policymaking and promote actions that will protect humans and the environment? What legal framework provides adequate flexibility to deal with an uncertain world while protecting fragile resources?

The University of Nebraska College of Law hosted the “Resilience & Environmental Law Reform Symposium” (the “Symposium”) on

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September 25, 2008, to consider these issues. The Symposium addressed the management of public natural resources, which include land and water resources that are under the ownership or control of the federal or state government; and, to a lesser extent, private resources. The five papers presented at the Symposium, drafts of the articles published in this issue, considered the role that law and the concepts of resilience and adaptive management play in shaping management practices. Topics ranged from general thoughts about the relationship between sustainability and environmental law to case studies regarding how law has affected the restoration of particular sites and specific proposals for legal reform.

The Symposium considered a possible shift in the fundamental principles guiding resource management to concepts such as resilience, adaptive management, and sustainable development. "Ecosystem resilience is the capacity of an ecosystem to tolerate disturbance without collapsing into a qualitatively different state."¹ Adaptive management "integrat[es] environmental with economic and social understanding at the very beginning of the process, in a sequence of steps during the design phase and after implementation,"² creating "a changing adaptive process of policy design."³ Sustainable development is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."⁴ Generally speaking, resilience and sustainability are characteristics of environmental systems and are often the goals of management activities. Adaptive management is a process for getting there—for managing or taking care of a system. While these concepts have been around for several decades, they have not been as widely implemented as some might wish. One of the overarching questions addressed in the Symposium was whether use of the concepts of resilience and adaptive management could enhance protection for natural resources.

This Introduction provides brief summaries of each of the five Symposium articles. Some of the recurring themes are then explored, including unanswered questions about natural resource management that could be addressed in future research. Several key points deserve

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1. Lance Gunderson & Sandra Zellmer, *Why Resilience May Not Always Be a Good Thing: Lessons in Ecosystem Restoration from Glen Canyon and the Everglades*, 87 NEB. L. REV. (2009) (citing C.S. Holling, *Resilience and Stability of Ecological Systems*, 4 ANN. REV. ECOLOGY & SYSTEMATICS 1-23 (1973)).
 2. Mary Jane Angelo, *Stumbling Toward Success: A Story of Adaptive Law and Ecological Resilience*, 87 NEB. L. REV. (2009) (quoting ADAPTIVE ENVIRONMENTAL ASSESSMENT AND MANAGEMENT 19 (C.S. Holling ed., 1978)).
 3. *Id.* (quoting ADAPTIVE ENVIRONMENTAL ASSESSMENT AND MANAGEMENT 19 (C.S. Holling ed., 1978)).
 4. Gunderson & Zellmer, *supra* note 1 (quoting WORLD COMM'N ON ENV'T & DEV., OUR COMMON FUTURE 43 (1987)).

emphasis: (1) disputes over natural resource management are grounded in disagreement over goals; (2) science, law, and politics all influence, inform, and complicate management; (3) natural systems are subject to both natural and human induced stresses; (4) tensions exist between the needs for experimentation and for accountability; (5) stakeholder involvement can both enhance and complicate management; and (6) context matters. This Introduction ends with a statement about the use of resilience and adaptive management to frame natural resource management issues.

II. THE SYMPOSIUM ARTICLES

Robert L. Glicksman describes the additional and sometimes unique challenges that climate change will pose for federal land management.⁵ He notes that current law and practice often fail to provide sufficient protection for public lands, and that climate change will increase stresses in the future. Adopting a conservation biology paradigm, Glicksman suggests ten changes in law and policy to help federal land managers to better mitigate the causes of, and adapt to, the impacts of climate change. He goes on to suggest changes in practice that can increase resilience and facilitate adaptation. Many of these suggestions are intended as “no regrets” practices that will improve management of federal lands whether or not the climate changes.

Lance Gunderson and Sandra Zellmer describe how federal and state resource managers have approached the challenges of resource management in the extremely complex systems of the Florida Everglades and the Grand Canyon of the Colorado River.⁶ These sites clearly demonstrate the difficulties encountered in managing degraded ecosystems and show how different approaches can lead to the success or failure of a project. The authors provide an overview of existing federal laws controlling natural resource management and use the two case studies to illuminate the links between “ecological principles and legal analysis.”⁷ They show that resilience, a concept that applies to social as well as ecological systems, may not always help to achieve restoration goals, in part because the intransigence of human groups may interfere with progress towards restoration.

Craig Allen, Heriberto Cabezas, and Ahjond Garmestani apply systems theory to the governance of environmental problems such as sus-

5. See generally Robert L. Glicksman, *Ecosystem Resilience to Disruptions Linked to Global Climate Change: An Adaptive Approach to Federal Land Management*, 87 NEB. L. REV. (2009).

6. See generally Gunderson & Zellmer, *supra* note 1.

7. *Id.*

tainability.⁸ They describe such governance as a “panarchy,” which they define as “a nested set of adaptive cycles.”⁹ Their article stresses the need for an adaptive approach, both in terms of resource management and policy development.

Mary Jane Angelo’s story of Lake Apopka provides a case study of how adaptive management can be used successfully to restore a badly degraded system.¹⁰ Her story is encouraging, but also describes the many barriers that complicate restoration efforts. The Lake Apopka project managed to succeed under existing laws and policies, but only through a process of trial and error. Angelo suggests ways that laws could be modified to promote adaptive management.

Finally, Alyson Flournoy steps back from specific case studies and takes a “big picture” approach by proposing sweeping new legislation—the National Environmental Legacy Act (“Legacy Act”)—designed to provide more effective protection for resources on federal lands than the current legal regime.¹¹ She suggests that protection can best be achieved, not by tweaking the current system, but by creating a new standard in an omnibus statute to cover federal natural resource management. Her proposed Legacy Act would set explicit objectives and limits on degradation in order to preserve resources for future generations.

III. RECURRING THEMES

A. Goals and Objectives

The Symposium articles repeatedly indicate that our current system lacks consensus on the goals of management and restoration of natural resources, especially public resources. Current resource management laws overflow with conflicting provisions. The very concept of “multiple use” highlights the differing interests that vie for control of our public lands. The Symposium articles reflect the ongoing conflicts between development and conservation, but their suggestions for improving the system generally come down squarely on the side of conservation and sustainability, an approach which may not reflect the varied objectives of American society. The current conflicts between multiple use and conservation reflect an ongoing diversity in societal goals that seems likely to continue for the foreseeable future. Thus, the following question remains: How do we balance conserva-

8. See generally Craig R. Allen et al., *Panarchy, Adaptive Management and Governance: Policy Options for Building Resilience*, 87 NEB. L. REV. (2009).

9. *Id.*

10. Angelo, *supra* note 2.

11. See generally Alyson C. Flournoy, *Protecting a Natural Resource Legacy While Promoting Resilience: Can It Be Done?*, 87 NEB. L. REV. (2009).

tion goals against commercial, recreational, and other uses of public resources without putting those resources at risk?

The Symposium case studies reflect the current lack of political support for conservation and restoration in the face of demand for competing uses of public resources. The Everglades case in particular suggests that the public will support restoration as long as they can have all the water, flood control, and other services that the growing Florida population demands. The problem, as Gunderson and Zellmer point out, is that we cannot manage to maximize more than one variable at a time.¹² When choices must be made, economics tend to trump conservation. What makes the Lake Apopka case so appealing is that managers were able to overcome diverse stakeholder values and focus on restoration, in spite of a series of major setbacks.¹³ Ultimately, the Symposium authors may be seeking a change in priorities more than a change in management approaches. They require not just "clear guidance from Congress,"¹⁴ but also clear guidance grounded in strong support for conservation values.

Even when people agree that conservation is the primary management goal, questions remain about just what should be conserved. Are we trying to maintain the status quo? Or do we want to maintain natural systems, even if those systems are in flux? When should we manage for resilience, and when should we manage for transformability? At what point does human management become so intrusive that we are no longer managing a natural system? Who should get to decide what values are to be maximized with respect to public resources? Flournoy recognizes some of these issues and distinguishes among natural changes and changes due to past or to future human activities in discussing protections to be provided through her Legacy Act.¹⁵ It remains unclear, however, whether conservation should be explicitly defined at the national level or left for site-level decision-making.

All of the articles assume that management should focus primarily on the maintenance of current ecosystems and the myriad services they provide. While recognizing the conflict with multiple use statutes and values, the authors do not directly address how to move Congress away from consumptive uses and toward conservation. Ultimately, the battle may be more about the values underpinning the goals of public resource management rather than the management approach or methods.

Many, possibly most, of the recommendations coming from the Symposium will require additional resources, in terms of time, fund-

12. Gunderson & Zellmer, *supra* note 1.

13. See Angelo, *supra* note 2.

14. Gunderson & Zellmer, *supra* note 1.

15. Flournoy, *supra* note 11.

ing, and attention. Research, monitoring, restoration, and enforcement are expensive and require both attention and willingness to pay from lawmakers. Natural resources must compete with other priorities for attention from Congress and other decision-makers. Many environmental laws have been forged in response to a crisis, such as the burning Cuyahoga River or chemicals seeping into basements near Love Canal.¹⁶ Creeping environmental problems¹⁷ such as climate change and resource degradation are unlikely to compel much attention until they also reach a crisis point. Increasing political support for resource protection will require more persuasive stories about how the American public will benefit from the money and time devoted to management of public resources.

B. Language and Framing

Language and framing play an important role in the way we think about natural resources management. One of the purposes of the Symposium was to use a different set of concepts to frame the coming challenges faced by both human and natural systems. All of the articles demonstrate how these concepts may be applied, but the articles also recognize ambiguities in the way the terms are defined and implemented.¹⁸ “Sustainable development” and “sustainability” are notoriously slippery terms. The U.S. Fish and Wildlife Service has tried for many years to support adaptive management but some believe that its approach “does not allow for learning and experimentation, which are at the heart of what adaptive management (*sensu* Holling) requires.”¹⁹

Are these concepts more useful than others in managing natural resources? Do they provide clear direction for managers? The answers remain unclear. The lack of common understanding complicates the use of these terms to guide management and may allow different stakeholders to slant definitions to support their own values and interests.

16. See generally Sandra Zellmer, Essay, *A Tale of Two Imperiled Rivers: Reflections From a Post-Katrina World*, 59 FLA. L. REV. 599, 625 (2007) (describing congressional responses to the wreck of the Exxon-Valdez, the release of deadly chemicals from a Union Carbide plant in India, and the discovery of toxic wastes at Love Canal, New York).

17. Glantz describes creeping environmental problems as “slow-onset, low-grade, long-term and cumulative environmental changes . . .” CREEPING ENVIRONMENTAL PROBLEMS AND SUSTAINABLE DEVELOPMENT IN THE ARAL SEA BASIN 3 (Michael H. Glantz ed., 1999).

18. Glicksman, for example, notes that “The symposium articles address resilience from a variety of perspectives, not all of which conceptualize resilience in the same way.” Glicksman, *supra* note 5.

19. Allen et al. *supra* note 8.

C. Science, Uncertainty, and the Importance of Context

The authors advocate adaptive management, grounded in the best available science, but the authors also acknowledge the uncertainties inevitable in science dealing with complex systems. Adaptive management involves a process of experimentation, of trial and error, that is intended to both increase scientific understanding and to improve management decisions by providing flexibility to change direction based on new information.

Flournoy discusses the inherent tensions between the law's quest for certainty and science's inherent uncertainties and need for flexibility. She argues that we need "legal regimes that are enforceable, achieve clear results, and yet permit flexibility in their implementation—a seeming oxymoron."²⁰ Much of her article focuses on the tensions between law and science. Allen, Cabezas, and Garmestani also describe the tension between science and law,²¹ as does Glicksman.²² The articles focus less on the disagreements among scientists themselves that may also complicate management decisions.

The authors all deal with issues of resilience. Some talk about the need to build resilience against shocks, while others consider how to overcome resilience in entrenched social systems. Both approaches require an understanding of how resilience works, yet the examples provided suggest that the concept of resilience may be so context-dependent that it is difficult to generalize principles across scales or across situations.

D. Managerial Discretion and Accountability

Flournoy describes the tension between restricting resource management discretion in order to ensure compliance with conservation objectives, while also allowing managers the flexibility to try experiments that will lead to better decisions. Flexibility can cut both ways. More discretion may allow managers to be more responsive to new information about ecosystems, but it also may give them more discretion to support consumptive or other uses that are inconsistent with conservation goals. Discretion allows managers to select the kinds of information they will consider, to design and conduct experiments, to set thresholds for stopping an experiment, and to change course in response to new information. Flournoy advocates clear mission statements to avoid this problem, but that assumes consensus on goals that Congress may not be able to reach.

Several of the articles discuss the need to hold managers accountable, but there is a question as to what they should be accountable for.

20. Flournoy, *supra* note 11.

21. Allen et al., *supra* note 8.

22. Glicksman, *supra* note 5.

Glicksman would use judicial review to make sure agencies comply with law and policy.²³ Gunderson and Zellmer raise questions about which measures of success to apply. Is it enough, as the authors imply, to promote learning through experimentation? Or should success be measured in terms of improvements in ecological services or in availability of economic resources? Or is success simply a matter of public satisfaction with the state of the system?

Experiments alone do not increase resilience or improve ecological conditions. Experiments may even harm individual species or even entire ecosystems, as the Lake Apopka case demonstrates. The idea is that, over time, learning based on experimentation will lead to better management of natural systems, but progress can be slow. The Grand Canyon, for example, has succeeded in pursuing some experimentation, but this has not necessarily led to significantly improved ecological conditions.

E. Risk and Experimentation

Adaptive management requires a spirit of experimentation and a willingness to fail, but there are relative levels of failure, and some may have irreparable consequences, particularly when dealing with endangered species. How much experimentation should we encourage or allow? How much risk to ecosystems, to specific resources, or to economic interests should we tolerate?

Angelo notes that "ecological resilience is a measure of a system's ability to withstand failed management or regulatory systems."²⁴ In other words, attempts to increase resilience are, at least in part, intended to help ecosystems to resist the adverse impacts resulting from human behavior. Angelo also points out that a system must already be resilient in order to withstand the exploratory stresses of adaptive management.²⁵ Expanding on this idea, Gunderson and Zellmer state that experimentation can be better tolerated in a resilient system that can resist serious disruption or irreparable losses.²⁶ Without sufficient existing resilience, experiments run the danger of irreparable harm, such as the extinction of a species. Once an ecosystem is pushed into a different state, overcoming resilience will be at least as difficult as promoting it. The Lake Apopka case shows how resistant an ecosystem can be to efforts to return to a previous state once it has flipped into a new one. Unfortunately, it always seems easier to bump an ecosystem into a less desirable state than to restore it to more desirable and/or more natural conditions.

23. Glicksman, *supra* note 5.

24. Angelo, *supra* note 2.

25. *Id.*

26. Gunderson & Zellmer, *supra* note 1.

The trick, of course, is in understanding just how resilient a system is and how much additional stress it can withstand before an experiment is attempted. Gunderson and Zellmer assert that under a resilience-based approach, experimentation does “not trigger cascading instability of the whole because of the resilience of the whole.”²⁷ The challenge is in recognizing the resilience factors that will produce such stability. Presumably scientific experts would be expected to decide what limits to put on experimentation, but it is not clear whether scientists in a resilience-based approach would have a better understanding of system limits than they do under the current management systems. Angelo stresses that managers must anticipate possible failure and be prepared to minimize harm.²⁸ She also recognizes that “there may be instances where the risks are simply too high and where inaction is the preferable choice.”²⁹

All this leads back to the fundamental question of how much experimentation should be allowed, and how many and what kind of mistakes, even tragedies, we are willing to tolerate in order to learn more about the systems under public management. Accountability, or even liability for harm, should be discussed and decisions made as to when, if ever, scientists and land managers should be held responsible for their well-intended mistakes. The need to protect fragile resources must be balanced against the possibility of discouraging innovative adaptive management practices. Adaptive management appears to require courageous leaders who are not only willing to take risks and live with the consequences, but who are also able to deal with the legal and political responses to their mistakes.

F. Law and Policy

One of the strongest themes of the Symposium articles is the call for changes in the laws governing the management of publicly owned or managed natural resources. The authors contend that current environmental laws may be too rigid to support wise resource management. Above all, the authors call for a dynamic management model that allows experimentation to reach agreed upon goals in a world of scientific, political, and economic uncertainty.

Both Glicksman and Flournoy discuss the inadequacy of existing federal statutes to protect public natural resources. Flournoy highlights the inconsistent objectives and inherent ambiguities in existing laws, as well as the inherent tension between science and law. She designed her Legacy Act to remedy these problems, but her strict requirements, and reliance on the precautionary principle to avoid envi-

27. *Id.*

28. Angelo, *supra* note 2.

29. *Id.*

ronmental degradation, may stifle the kind of experimentation required for adaptive management, demonstrating the difficulty in drafting legislation that serves multiple goals.

The existing legal environmental framework certainly contains multiple conflicts and ambiguities. The question is whether the wobble in the current system should be stabilized, or whether it actually provides at least some of the flexibility needed to experiment with the management of natural resources. Reopening environmental laws also carries risk. Asking Congress to increase protection, or even to reauthorize existing laws, can actually produce watered down laws as lawmakers strive to reach agreement. Flournoy acknowledges that lawmakers' fear of political backlash can contribute to a stalemate,³⁰ but the risks of actually reversing the conservation gains made in environmental law since the 1970s are real and should not be discounted.

Change in law alone will not be enough. Many current laws allow some of the actions the authors are suggesting. Implementation is the problem. Land managers, faced with inadequate resources, conflicting mandates, and pressure from diverse stakeholders, often are unwilling or unable to comply with existing law and policy. Gunderson and Zellmer recognize the importance of implementation and include public administration as a critical element in any restoration effort.³¹ The ability to talk the resilience/adaptive management talk will be insufficient to get things done on the ground. Resource managers must also have the freedom, capability, and will to walk the walk and to implement these concepts in managing public resources.

G. Public Participation

Much has been written about the role of the public in environmental decisions in a democracy. Which stakeholders have a right to be involved in a decision? Which decisions and at what stages? What constitutes adequate involvement? When is it politically expedient to involve the public?

Gunderson and Zellmer and Angelo warn that involving stakeholders can lead to gridlock, particularly when consensus is required for action. Nevertheless, Angelo believes that "[p]ublic participation is critical for the success of any environmental management or restoration project"³² because public participation promotes public support. Angelo suggests a staged process in which the public helps in setting objectives, but then leaves decisions about strategies to scientists and

30. Flournoy, *supra* note 11.

31. Gunderson & Zellmer, *supra* note 1.

32. Angelo, *supra* note 2.

resource managers. She notes that building trust is important, and recognizes that scientists do not enjoy the trust they once did.

The management of public resources, however, extends beyond a scientific enterprise. Sound decisions rely on values, economics, cultural history, and many other factors in addition to science. The question remains as to which stakeholders should be involved in day to day decisions about what should be done and what risks to species, ecosystems, or economic interests should be tolerated. Leaving these decisions to scientists and other "experts" may provide too narrow a view of the nature of the risks and benefits of proposed actions. The particular team of scientists selected to work on a site will affect the way the problem is understood and how alternatives are generated. Each scientist will view the site through a lens influenced by the individual's values, interests, training, and experience. Different teams are likely to adopt different assumptions, hypotheses, and research methods, and will exhibit different tolerances for risk and innovation.

Scientists and resource managers are not entirely disinterested researchers and decision-makers. They have individual and collective interests that will be affected by the research in which they participate. Funding and salary levels, publication opportunities, and reputation will be linked to their work. Decisions about intermediate and long-term goals and the levels and types of risks that should be tolerated are arguably decisions that should involve stakeholders across the spectrum of values and interests.

IV. CONCLUSIONS

Can the concepts of resilience and adaptive management inform the debate over the protection of public natural resources and help to build public consensus? The Symposium articles identify the advantages of such framing, and explore some of the tensions with other points of view. Ultimately, the answer requires further experimentation with the concepts themselves. It remains to be seen whether the concepts can help to build support for ecosystem conservation, or whether a stronger public commitment to conservation must be in place before the concepts can be meaningfully applied on a widespread basis.

Political will is essential to support conservation objectives. Allen, Cabezas, and Garmestani point to the need for "small windows of opportunity during which different institutional and ecological components are appropriately aligned with one another to produce the necessary social, political and economic capitals."³³ Perhaps the challenges of climate change or the realities of seriously degraded ecosys-

33. Allen et al., *supra* note 8 (quoting Graeme S. Cumming et al., *Scale Mismatches in Social-Ecological Systems: Causes, Consequences, and Solutions*, 11(1):14

tems will open such a window, although such formidable challenges also could overwhelm the ability of the political system to focus on the management of public resources. Advocates and resource managers should assume that this time of profound change may open a window of opportunity for change, and be prepared to jump in with proposals for better laws to manage public natural resources.

As a final point, this Symposium demonstrates that societal context matters in talking about natural resource management. The first drafts of the Symposium articles were distributed in September 2008, before the meltdown of the U.S. and global financial systems. Changes in societal priorities now appear inevitable, at least for the short term. Perhaps what is needed, above all, are environmental laws and management policies that are resilient with respect to future economic and political shocks, while supporting and encouraging strong protection for natural resources.