Legal Frameworks for Adaptive Natural Resource Management in a Changing Climate

Article *in* Environmental Law Review · January 2010

CITATIONS
13

READS
364

2 authors, including:

Akiva Fishman
New York University
10 PUBLICATIONS **70** CITATIONS

SEE PROFILE

Legal Frameworks for Adaptive Natural Resource Management in a Changing Climate

DANIEL SCHRAMM* AND AKIVA FISHMAN†

INTRODUCTION

Climate change confronts natural resource managers around the globe with ecological disturbance on a massive scale.[1] It is transforming ecosystems by shifting temperature regimes and hydrological cycles, changing the chemical balance of oceans and freshwater systems, and altering the range and distribution of species, to list just a few impacts. Over the last several decades, countries throughout the world have enacted laws designed to protect their natural biological heritage. However, whether in the legal language itself or in the practice of interpreting and implementing it, the assumptions underlying these approaches to governance may fail to equip managers and stakeholders with the tools to effectively manage their resources for climate change.[2] Ecological understandings in a world undergoing climate change may be fundamentally different from those undergirding existing frameworks. Current laws often emphasize preserving the status quo, but adaptation increasingly focuses on conserving centers of evolution and maintaining ecosystem function. Laws thus can present barriers to the actions necessary for long-term adaptation. For example, they can prohibit translocation of endangered species or authorize levels of resource use that undermine the resilience of exploited ecosystems to climate change. With increasing competition for resources, expanding economic development, and the escalating effects of climate change, new approaches to the law and governance of biological resources are in critical demand.

This article argues that the principles of adaptive management provide a strong conceptual basis for evaluating and strengthening legal frameworks for climate

---

* Staff Attorney, Environmental Law Institute; J.D., Vermont Law School 2008. The authors wish to thank Carl Bruch, Scott Schang, Lara Hansen, Carroll Muffett, and Lyle Glowka for invaluable review and feedback.

† Research Associate, Environmental Law Institute; B.A. Brandeis University 2009.

1. *See, e.g.*, Joel B. Smith et al., *Assessing Dangerous Climate Change through an Update of the Intergovernmental Panel on Climate Change (IPCC) "Reasons for Concern,"* 106 PROC. NAT'L ACAD. SCI. 4133, 4134 (2009).

2. This article uses the term "biological diversity" (or "biodiversity") to refer to the intrinsic ecological value of variability in species and habitats. The more generic terms "biological resources," "bioresources," or "natural resources" are used synonymously to refer to both biodiversity and biota that have utile value in human livelihoods or economies. For example, a monoculture timber plantation is a biological resource even though it would not be considered a strong contributor to biological diversity.

change. Adaptive management facilitates resilient and robust decision-making frameworks that can nimbly respond to new information and changes in ecological conditions. Legal structures that promote tactical flexibility while keeping managers focused on achieving long-term sustainability objectives will be crucial to preserving biodiversity and ecosystem services well into an uncertain future. Additionally, this article examines several specific areas of natural resource policy into which adaptive management for climate change might be incorporated. After reviewing the background context for this argument, the article will examine three core functional needs of adaptive management where the role of law is particularly acute: baseline setting and monitoring requirements, periodic review and adjustment, and information sharing and learning across bureaucratic categories. The article will then look at a series of more specific applications of these principles:

- The role of environmental impact assessment (EIA) in facilitating adaptive management for climate change in large-scale projects that affect natural resources
- Devolved, collaborative resource management systems as a strategy for building adaptive capacity at local and regional scales; and
- Designing resilient matrices of protected areas to give ecosystems evolutionary "space" to adapt to climate change.

The article concludes with a brief analysis of the importance of incorporating principles of adaptive management and climate adaptation for biodiversity into market-based climate mitigation efforts that use biological systems, such as Reduced Emissions from Degradation and Deforestation (REDD) projects. The topics presented by no means cover the full range of resource management contexts in which the principles of adaptive management can be incorporated to improve responsiveness to climate change (others may include, for example, water supply, invasive species, hunting rights, or pollution standards).[3] Instead, the examples discussed demonstrate how those principles can be adapted to a variety of regulatory purposes. Finally, before proceeding, the authors note that although the article emphasizes the need for new thinking about our legal frameworks, this is not to say that much cannot be done within existing legislation and mandates, as examples throughout will demonstrate.

I. BACKGROUND: THE CLIMATE CHALLENGE

The planet's biodiversity is threatened with the most severe extinction event in 65 million years. The November 2009 update of the International Union for the

3. The Environmental Law Institute (ELI) is currently drafting guidance materials on possible legal and policy responses to climate change. These materials are slated for release in Fall 2010. For more information, see ELI, New Approaches for Conserving Biodiversity: Adapting Law and Governance to a Changing Climate, http://www.eli.org/Program_Areas/climate_biodiversity.cfm (last visited Feb. 22, 2009).

Conservation of Nature (IUCN) Red List reported that 17,291 of the 47,677 assessed species are threatened with extinction.[4] There is a growing body of evidence that climate change is accelerating these extinction rates. 15 to 37 percent of species from a sample of 1103 face extinction due to climate change by 2050.[5] It is becoming clear that population declines are not limited to rare species—population numbers of organisms long considered "immune" to extinction risk, such as timber and oceanic fish species, are also on the decline.[6] The most recently available trend lines show that climate change is already having a significant impact both on biodiversity and on biological resources that sustain livelihoods and economies.[7]

One study estimates that by 2050 climate change will have caused between approximately 500,000 and 1,000,000 square kilometers of land in Africa to become too arid for crop farming.[8] Global food production losses could lead to available food supplies of as little as 75% of demand by 2050,[9] by which time the human population is estimated to grow by over 2 billion people.[10] Climate change poses a significant risk to tropical rainforests and associated sectors and livelihoods, as sustained drying, warming conditions can cause forests to transition to savannah.[11] Marine ecosystems that support coastal communities face dire climate forecasts. Fish species are showing changes in population size and distribution as a result of the changing ocean climate. Many fisheries are moving to higher, cooler latitudes.[12] Coastal regions of Latin America, Africa, and Southeastern Asia are particularly vulnerable to fishery collapse as these areas rely heavily on the industry for food and income.[13] At carbon dioxide levels of 560 parts per million (possible by 2050), the combined effects of ocean

---

4. Press Release, International Union for Conservation of Nature (ICUN), Extinction Crisis Continues Apace (Nov. 3, 2009), http://www.iucn.org/?4143/Extinction-crisis-continues-apace.

5. Chris D. Thomas et al., Letter to Nature, *Extinction Risk from Climate Change*, 427 NATURE 145 (2004).

6. *See* R.T. Kingsford et al., *Major Conservation Policy Issues for Biodiversity in Oceania*, 23 CONSERVATION BIO. 834, 835 (2009).

7. *See, e.g.*, Smith et al., *supra* note 1.

8. Peter G. Jones and Philip K. Thornton, *Croppers to Livestock Keepers: Livelihood Transitions to 2050 in Africa Due to Climate Change*, 12 ENVTL. SCI. & POL'Y 427, 433 (2008). More specifically, based on multiple climatic models and emissions scenarios, these areas will move from greater than ninety reliable crop growing days (RCGD) to less than ninety RCGD, which will make them unsuitable for maize cultivation. *Id.* at 431.

9. U.N. Env't Programme (UNEP), *Rapid Response Assessment: The Environmental Food Crisis*, Summary, http://www.grida.no/publications/rr/food-crisis (last visited Feb. 3, 2010).

10. U.S. Census Bureau, World Population 1950–2050, http://www.census.gov/ipc/www/idb/worldpopgraph.php (last visited Mar. 21, 2010).

11. *See, e.g.*, Oliver L. Phillips et al., *Drought Sensitivity of the Amazon Rainforest*, 323 SCI. 1344 (2009). For a discussion of the recent controversy about the impacts of climate change on the Amazon rainforest, see Real Climate: Climate Science from Climate Scientists, Saleska Responds (Green is Green), Mar. 20, 2010, http://www.realclimate.org/index.php/archives/2010/03/saleska-responds-green-is-green/.

12. Chih-Hao Hsieh et al., *Climate Driven Changes in Abundance and Distribution of Larvae of Oceanic Fishes in the Southern California Region*, 15 GLOBAL CHANGE BIO. 2137, 2144 (2009).

13. Edward H. Allison et al., *Vulnerability of National Economies to the Impacts of Climate Change on Fisheries*, 10 FISH & FISHERIES 173, 184 (2009).

temperature rise, acidification and bleaching could reduce the calcification rates of all coral reefs by 80 percent or higher. Reefs and shellfish will be vulnerable to dissolution in new "acid bath" oceans.[14] This places at risk tourism-dependant livelihoods in the Caribbean and Oceania. Bird species are migrating further north and to higher elevations to find breeding grounds, causing an increase in disease, fatigue, and mortality rates, as well as moving birds and dependant populations outside traditional protected areas.[15] In 2006, Emperor Penguins chose a breeding spot on ice that succumbed in a strong storm, resulting in what one researcher called "total colony wide breeding failure."[16] Indeed, climate change may have already claimed its first victims. The warming climate in Latin American tropical rainforests is likely responsible for the spread of a fungus that drove the famed golden toad to extinction.[17]

These impacts threaten to undermine vital ecosystem services that protect humans from the most destructive effects of climate change. Vibrant and healthy ecosystems provide buffer zones around human development, protecting humans and the surrounding environment from potential devastation due to natural and climate-related disasters.[18] This has been recognized by the international community in the Ramsar Convention, which includes as an objective, "Ensuring the recognition by Contracting Parties of the role of coastal wetlands in mitigating impacts of climate change and sea-level rise."[19] Forests help prevent soil erosion and landslides; sand dunes, coral reefs, and mangroves protect the shore from wave surges; and wetlands help prevent flooding.[20] Coral reefs protect the coast from sea surges and tropical storm waves by absorbing the kinetic energy of tsunamis.[21] For example, in Sri Lanka it is estimated that one kilometer of coral

---

14. Jacob Silverman et al., *Coral Reefs may Start Dissolving when Atmospheric CO_2 Doubles*, 36 GEOPHYSICAL RES. LETTERS L05606, para. 1 (2009).

15. Nathalie Doswald et al., *Potential Impacts of Climate Change on the Breeding and Non-breeding Ranges and Migration Distance of European Sylvia Warblers*, 36 J. BIOGEOGRAPHY 1194, 1204 (2009).

16. P. Dee Boersma, *Penguins as Marine Sentinels*, 58 BIOSCIENCE 597, 599 (2008).

17. J. Alan Pounds et al., *Widespread Amphibian Extinctions from Epidemic Disease Driven by Global Warming*, 439 NATURE 161, 162 (2006).

18. UNEP, ISDR Working Group on Env't and Disaster Reduction, *Environment and Disaster Risk: Emerging Perspectives*, 8 (July, 2008) [hereinafter Environment and Disaster Risk].

19. Eighth Meeting of the Conference of the Contracting Parties to the Convention on Wetlands, Valencia, Spain, Nov. 18–26, 2002, *Wetlands: Water, Life and Culture, Resolution VIII.4: Wetland Issues in Integrating Coastal Zone Management*, Guideline 6, *available at* http://www.ramsar.org/pdf/res/key_res_viii_04_e.pdf. Possible activities include "managed landwards reinstatement of coastal wetland habitats through removal of sea defense structures, designing multiple-use reserves and protected areas which incorporate corridors that would allow for migration of organisms as a response to climate change; expanding aquaculture that could relieve stress on natural fisheries; specific management in some ecosystems; and integrated resource management." *Id.* at para. 32.

20. ICUN, ECOSYSTEMS, LIVELIHOODS AND DISASTERS: AN INTEGRATED APPROACH TO DISASTER RISK MANAGEMENT 13 (Karen Sudemeier-Rieux et al. eds., 2006) [hereinafter DISASTER RISK MANAGEMENT], *available at* http://data.iucn.org/dbtw-wpd/edocs/CEM-004.pdf; Environment and Disaster Risk, *supra* note 18, at 8.

21. DISASTER RISK MANAGEMENT, *supra* note 20, at 37; John R. Labadie, THE UNEXPLORED NEXUS:

reef protects five kilometers of shoreline.[22] Depending on their health, mangroves can soak up 70–90 percent of the energy from wind-generated waves.[23] Deforestation also increases runoff and flood peak levels,[24] resulting in greater flood risk in many parts of the world.[25] Environmental degradation exacerbates environmental disasters related to climate change; it intensifies impacts on victims and complicates recovery efforts.[26] Moreover, positive feedback loops may increase the vulnerability of a degraded ecosystem to further degradation, for example, by enabling invasion by alien species.[27]

II. THE PROBLEM: A FAILURE TO RESPOND

Amidst these threats, perhaps the greatest challenge facing policymakers is the inherent uncertainty that surrounds the effects of climate change over long time-horizons. For example, end-of-century sea-level rise projections range from a few centimeters to two or more meters.[28] Models are not always able to predict the frequency, severity, and location of extreme weather events, much less the secondary effects, such as fire and invasive species spread. In many parts of the world, incomplete or very short historical records make it difficult to establish baselines against which to compare changing conditions. This limits managers' ability to adjust and respond to climate change's dynamic effects. For example, if managers lack a baseline for rates of recruitment in tropical forests, they will be unable to know whether current rates are attributable to climate change or some other cause, and thus unable to develop a management response.[29] This uncertainty can paralyze management efforts for biological resources. A 2009 survey of nearly two-hundred resource managers in the United States and the United Kingdom found that their climate adaptation efforts were weak to non-existent, because:

- Available resources go to more immediate needs; 71 percent of officials rated the option 'non-adaptation activities are higher priorities' as "very or extremely challenging when considering climate change adaptation efforts."

ENVIRONMENTAL MANAGEMENT AND EMERGENCY MANAGEMENT IN POST-DISASTER RECONSTRUCTION 4 [hereinafter UNEXPLORED NEXUS], http://www.gdrc.org/uem/disasters/disenvi/labadie-john.pdf (last visited Mar. 22, 2010).

22. DISASTER RISK MANAGEMENT, *supra* note 20, at 14.

23. *Id*. at 37.

24. GLENN DOLCEMASCOLO, ASIAN DISASTER PREPAREDNESS CTR., ENVIRONMENTAL DEGRADATION AND DISASTER RISK 10 (Feb. 2004), http://www.unisdr.org/eng/risk-reduction/sustainable-development/Environmental-Degradation-and-Disaster-Risk.pdf.

25. *Id.*

26. UNEXPLORED NEXUS, *supra* note 21, at 3.

27. *See id.* at 6.

28. Anil Ananthaswamy, *Sea Level Rise: It's Worse than We Thought*, NEW SCIENTIST, July 1, 2009.

29. *See, e.g.,* Ariel E. Lugo, *Novel Tropical Forests: The Natural Outcome of Climate and Land Cover Changes*, *in* CLIMATE CHANGE AND BIODIVERSITY IN THE AMERICAS 135, 136–39 (Adam Fenech et al. eds., 2008).

- "Insufficient site-specific data, such as local projections of expected changes, make it hard to predict the impacts of climate change, and thus hard for officials to justify the current costs of adaptation efforts for potentially less certain future benefits."
- "Adaptation efforts are constrained by a lack of clear roles and responsibilities" among different levels of government officials.[30]

Dire global statistics may motivate international action to reduce greenhouse gas emissions, but they mean little in themselves to the forest management authority of a small country or an official charged with maintaining sustainable fishing quotas. Ultimately, our understanding of aggregate climate change impacts does not necessarily imply an understanding of local impacts subject to profound regional variation.

Nonetheless, uncertainty about precise impacts should never be used to forestall taking strong action now to prepare for and respond to those impacts. This is the central wisdom of the Precautionary Principle, as stated in the Rio Declaration of 1992: "In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."[31] In applying this principle to the uncertain risks that climate change poses, we should begin now to create resilient governance frameworks that allow managers, stakeholders, and NGOs to take proactive measures and adjust tactics and strategies as new information or changing conditions require.

This may mean that laws themselves should undergo an "adaptive capacity" analysis to determine whether they can drive sustainability goals in the face of climate impacts. The Conference of Parties to the Convention on Biological Diversity (CBD) recognizes the importance of reviewing national-level resource laws, encouraging national governments to "integrate biodiversity considerations into all relevant national policies, programmes and plans in response to climate change; taking into account the maintenance and restoration of the resilience of ecosystems which are essential for sustaining the delivery of their goods and services."[32] Continued operation of laws that fail to consider fluctuations in ecological conditions can present barriers to actions necessary for long-term adaptation. Such laws may, for example, require officials to dedicate resources

---

30. U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-10-175T, CLIMATE CHANGE ADAPTATION: STRATEGIC FEDERAL PLANNING COULD HELP OFFICIALS MAKE MORE INFORMED DECISIONS 4 (2009).

31. U.N. Conference on Environment and Development, June 3-14, 1992, *Rio Declaration on Environment and Development*, princ. 15, U.N. Doc. A/CONF.151/26 (Aug 12, 1992).

32. Conference of the Parties to the Convention on Biological Diversity, Eighth Meeting, Curitiba, Brazil, Mar. 20-31, 2006, *Decisions Adopted by the Conference of the Parties to the Convention on Biological Diversity at Its Eighth Meeting*, Decision VIII/30, para. 1, U.N. Doc. UNEP/CBD/COP/DEC/VIII/30 (June 15, 2006) [hereinafter *Conference Decision* VIII/30], *available at* http://www.cbd.int/decision/cop/?id=11044.

toward biodiversity protection that will be ineffectual under future climate conditions, or forbid the relocation of endangered species. This concern is exemplified in a 1996 case in which the Kenyan High Court granted an injunction against the Kenya Wildlife Service moving the rare *hirola* antelope to a protected area outside its native habitat.[33] The court reasoned that the authorizing statute for wildlife protection only "entitle[s] [the Service] to conserve the wild animals in their *natural state*. It does not entitle it to translocate them" to new habitat.[34] Climate change voids this reasoning. Underlying assumptions about what characterizes the "natural state" in a world where climate change is profoundly disrupting ecosystems simply may be obsolete.

A look at current environmental legal regimes reveals a number of systemic weaknesses that pose barriers to incorporating and responding to the impacts climate change will have on biological resources. These weaknesses frustrate environmental governance under changing ecological conditions. Examples include:

- Lack of tangible objectives, measurable criteria, or procedures for data collection, analysis, and use make it difficult to measure laws' effectiveness.
- Permits that confer broad use rights for extended periods of time without re-opener clauses provide users with carte blanche to exploit resources.
- Monitoring and reporting that is only required to assure compliance with management plans or permit conditions may not be responsive to changes in ecological conditions or trends in the overall status of natural resources.
- Information that is collected may be of little value if officials are not required to use it to inform future decision making; but front-loaded decision-making processes discourage officials from meaningful periodic review and mid-course correction.
- Bureaucratic confusion due to "stove piping" of environmental management responsibilities (e.g., land law, air law, water law, laws governing access to and use of natural resources, protected area law, etc.) rather than holistic, ecologically-attuned legal structures may result in extraneous or conflicting policies.

III. DESIGNING LEGAL FRAMEWORKS FOR ADAPTIVE MANAGEMENT

The above weaknesses stem from both rigidity in the administrative procedures of the law and the absence of mandates to achieve long-term tangible objectives. The complexity of ecological systems (coupled with far reaching

33. *Abdikadir Sheikh Hassan v. Kenya Wildlife Serv.*, Civil Case No. 2959 of 1996 (Kenya, Aug. 29, 1996), *reprinted in* COMPENDIUM OF JUDICIAL DECISIONS ON MATTERS RELATED TO THE ENVIRONMENT: NATIONAL DECISIONS, VOLUME 1 (1998), at 295, *available at* http://www.unep.org/padelia/publications/Jud.Dec.Nat.pre.pdf.

34. *Id.* (emphasis in original).

human impacts) quickly outpaces many legal frameworks' capacity to respond,[35] while an absence of long-term tangible objectives creates a tendency toward reactive rather than proactive policies.[36] This situation, combined with the impacts of climate change, is a compelling call for adaptive management to be incorporated at all levels of governance.

Adaptive management is not synonymous with climate adaptation, but provides a robust methodology for adaptation laws and policies.[37] Adaptive management takes a holistic, ecosystem-level approach to environmental issues, using iterative phases of implementation, monitoring, and adjustment to improve understanding and management of natural systems. At its core it "involves synthesizing existing knowledge, exploring alternative actions, making explicit predictions of their outcomes, selecting one or more actions to implement, monitoring to determine whether outcomes match those predicted, and using these results to adjust future plans."[38] Adaptive management is thus often expressed in the simple phrase "learning-by-doing." Natural resource managers and scientists engaged in environmental analysis and planning developed the methods of adaptive management in the 1970s. They viewed front-loaded decision-making processes such as environmental impact assessments (EIAs) as inhibiting more effective management through experimentation and learning over time.[39] An overtly adaptive decision-making approach recognizes imperfect knowledge and complexity in ecosystems as well as the need to account for humans' intended and unintended influences on them.[40] Adaptive management has been illustrated in a variety of ways, but one prominent effort to define it in

---

35. Adam B. Smith, *International Biodiversity Governance and the Outpacing of Policy by Threats: How Can Conservation Regimes Address Global Climate Change*, *in* HANDLING GLOBAL CHALLENGES: MANAGING BIODIVERSITY/BIOSAFETY IN A GLOBAL WORLD 398, 399 (Jo Swinnen et al. eds., 2009).

36. *See* Arie Trouwborst, *International Nature Conservation Law and the Adaptation of Biodiversity to Climate Change*, 21 J. ENVTL. L. 419, 424 (2009) (noting the need for "international nature conservation law to shift from reactive and *ad hoc* approaches to proactive and holistic ones").

37. *See* Peter Kareiva et al., *Synthesis & Conclusions*, in U.S. CLIMATE CHANGE SCIENCE PROGRAM & THE SUBCOMMITTEE ON GLOBAL CHANGE RESEARCH, PRELIMINARY REVIEW OF ADAPTATION OPTIONS FOR CLIMATE-SENSITIVE ECOSYSTEMS AND RESOURCES 9-25 (2008), *available at* http://www.climatescience.gov/Library/sap/sap4-4/final-report/sap4-4-final-report-Ch9-Synthesis.pdf ("Climate 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."). *See also* Robert L. Glicksman, *Ecosystem Resilience to Disruptions Linked to Global Climate Change: An Adaptive Approach to Federal Land Management*, 87 NEB. L. REV. 833, 870 (2009) (noting that current efforts at adaptive management have been poorly implemented and viewed unfavorably by reviewing courts).

38. Carol Murray and David Marmorek, *Adaptive Management and Ecological Restoration*, *in* ECOLOGICAL RESTORATION OF SOUTHWESTERN PONDEROSA PINE FORESTS 417–18 (Peter Friederici ed., 2003).

39. *See generally* ADAPTIVE ENVIRONMENTAL ASSESSMENT AND MANAGEMENT (C.S. Holling ed., 1978).

40. *See* Bradley C. Karkkainen, *Collaborative Ecosystem Governance: Scale, Complexity, and Dynamism*, 21 VA. ENVTL. L.J. 189, 202–03 n.35 (2002) (noting Holling's term is "often used broadly to mean any adaptive approach that seeks to respond to changing conditions or subsequently acquired knowledge" while ecologists tend to limit the term to a "specific experimental design in which an uncertain policy hypothesis is put to experimental verification by being implemented for a provisional period under carefully delimited conditions.")

the context of river basin restoration and management in the United States includes the following eight elements:

1. Definition of the problem;
2. Determination of goals and objectives for ecosystem management;
3. Determination of the ecosystem baseline;
4. Development of conceptual models;
5. Selection of future restoration actions;
6. Implementation of management actions;
7. Monitoring and ecosystem response;
8. Evaluation of restoration efforts and proposal for remedial actions.[41]

Although to date adaptive management has been practiced primarily in developed countries with relatively high technical and scientific capacities, it is capable of being modified to serve in a variety of socio-ecological and economic contexts. The CBD's *Addis Ababa Principles and Guidelines for the Sustainable Use of Biodiversity* explicitly call on governments throughout the world to use a form of adaptive management in regulating access to and use of biodiversity that incorporates traditional and indigenous knowledge in addition to scientific data.

Adaptive management should be practiced, based on:

(a) Science and traditional and local knowledge;
(b) Iterative, timely, and transparent feedback derived from monitoring the use, environmental, socio-economic impacts, and the status of the resource being used; and
(c) Adjusting management based on timely feedback from the monitoring procedures.[42]

Climate change provides the impetus and the opportunity to "scale up" adaptive management principles, building them into the fabric of law and governance in a variety of new resource management contexts.[43] The priorities for policymakers

---

41. J.B. Ruhl, *The Pardy-Ruhl Dialogue on Ecosystem Management, Part IV: Narrowing and Sharpening the Questions*, 24 PACE ENVTL. L. REV 25, 29 n.17 (2007) (citing COMM. ON ENDANGERED & THREATENED FISHES IN THE KLAMATH RIVER BASIN, NAT'L RESEARCH COUNCIL, ENDANGERED AND THREATENED FISHES IN THE KLAMATH RIVER BASIN: CAUSES OF DECLINE AND STRATEGIES FOR RECOVERY 333–35 (2004)).

42. Secretariat of the Convention on Biological Diversity, *Addis Ababa Principles and Guidelines for the Sustainable Use of Biodiversity*, Practical principle 4, at 11 (2004), *available at* http://www.biodiv.org/doc/publications/addis-gdl-en.pdf.

43. *See* Joseph Arvai et al., *Adaptive Management of the Global Climate Problem: Bridging the Gap between Climate Research and Climate Policy*, 78 CLIMATIC CHANGE 217, 219 (2006).

There are at least three reasons to believe a priori that adaptive management is a useful way to approach the problem of global climate change. First, . . . mitigation and adaptation strategies will interact with each other and with natural variables, creating a complicated dynamic of cause and effect where most important variables will be both exogenous and endogenous. . . . Second, adaptive management is appealing because of the sheer complexity of the climate change problem coupled with the need to make management decisions under uncertainty. . . . Finally, adaptive management is inclusive and flexible in terms of the precise goals of climate change policy and the means used to achieve them. *Id.*

will be to transform discretionary management authorities that may currently be perceived as "extras" into clear mandates for: (1) scientific baseline-setting, monitoring, and reporting; (2) goal-setting with periodic reviews and adjustments; and (3) interagency and inter-jurisdictional cooperation and coordination. This section takes a closer look at legal issues related to these three core functional areas of adaptive resource management.

A. LEGAL MANDATES FOR SCIENTIFIC BASELINES, MONITORING, AND REPORTING

Perhaps the most essential predicate for strong adaptive management is the requirement for scientific data collection through monitoring, information reporting, and auditing, so that all relevant actors (officials, businesses, resource users, non-governmental organizations, etc.) are kept aware of the relevant ecological and human behavioral trends, as well as the efficacy of current approaches to resource conservation. The first step in this process is identifying a baseline of conditions against which to evaluate changes in the environment over time. Setting a baseline can be difficult where limited historical records are available, but there are models for how to go about this.

An excellent example is the Seychelles' 2007 "National Plan of Action for the Conservation and Management of Sharks" (NPOA). Rather than looking at the current status of shark fisheries, or even to the recent past of the late-twentieth century, the NPOA drafters went as far back in the historical record as they could, starting with a survey of sailor journals from the 1700s that reported coastal waters teeming with sharks.[44] From this baseline, the NPOA traces the development of artisanal and then commercial shark fisheries over the past two hundred years, relying on academic articles, first-person accounts, government reports, and field research.[45]

Taking a longer view allowed managers and stakeholders to reach the conclusion that "the weight of evidence indicates a significant decline in shark stocks during the second half of the 20th century" and that "the fishery as a whole [can] be characterized as overexploited and depleted."[46] Armed with the new understanding that current shark populations are vastly diminished from their levels prior to significant human exploitation, the planners were able to make a determination that strong immediate action was needed. Under the Work Programme "Managing Effort in Line with a Precautionary Approach," the NPOA briefly reviewed the findings from the baseline survey and stated: "This decline . . . is sufficient to warrant an active and progressive application of a

---

44. SEYCHELLES FISHING AUTHORITY, NATIONAL PLAN OF ACTION FOR THE CONSERVATION AND MANAGEMENT OF SHARKS 12–15 (2007), *available at* ftp://ftp.fao.org/FI/DOCUMENT/IPOAS/national/seychelles/Seychelles NPOA_Sharks.pdf.

45. *Id.* at 15–17.

46. *Id.* at 14, 19.

precautionary approach to the management of effort in both targeted and incidental shark fisheries."[47] The NPOA called for legislation within six months to establish a strict licensing and catch-limit regime, to prohibit techniques and technologies that over-exploit sharks, and to close the fishery to new operators for a four year review period.[48]

Monitoring requirements are already frequently called for in existing resource management frameworks. However, the output of such requirements may be limited by too narrow a focus on one or two environmental factors (rather than providing for an ecosystem view of the region that covers all relevant indicators). Monitoring requirements that cover only the impacts of individual resource-user projects may not be sufficient to give mangers or policymakers a complete understanding of the interactive or synergistic effects of changing ecological conditions (e.g., resulting from climate change) concurrent to resource exploitation. In Namibia, monitoring is defined to include only "verification of impact predictions, evaluation of mitigatory measures, adherence to approved plans, and general compliance with the Environmental Agreement."[49] If monitoring under this provision were the only source of information, even if the listed indicators were fully and accurately monitored, officials and the public would likely lack sufficient understanding of the area's overall ecological status. This does not necessarily mean that resource users (especially those exploiting a resource for subsistence) should be required to track complex trends in the structure and function of ecosystems. Rather, this is a call to prioritize and mandate information collection, dissemination, and analysis, whether undertaken by the government, resource users, or through leveraging the resources of businesses, academia, NGOs, or other civil society actors.

B. LEGAL MANDATES FOR PERIODIC REVIEW AND ADJUSTMENT

The purpose of monitoring, of course, is to give decision-makers the information they need to make adjustments to improve management outcomes in response to new factors or information. The ability to respond quickly to new threats is a critical component of climate adaptation. But laws regulating the use of resources have tended to be reactive to historical problems rather than proactive in setting up resilient frameworks to confront and respond, quickly and effectively, to new challenges and issues as they arise.[50] Mandates to review and reevaluate previous environmental choices can be used at multiple levels, from technical regulatory standards to legislation itself. This is an important principle

47. *Id.* at 34.

48. *Id.*

49. Namibia's Environmental Assessment Policy, App. A, para. 12 (1995) (Namib.), *available at* http://www.met.gov.na/programmes/eia/eiapolicy/NAMIBIAEIApolicy.pdf.

50. *See generally* Smith, *supra* note 35, at 399–405 (cataloging a century of failure in international marine mammal protections to effectively address new threats as they arise).

of adaptive management that applies at all levels of governance.

Policymakers may find it easiest to think about periodic review and adjustment requirements as a method to reduce the "time lags" inherent in environmental management as much as possible. Lags take place at two junctures: (1) *policy lags* occur between problem identification and policy implementation; (2) *response lags* occur between policy implementation and accomplishment of an environmental objective (e.g., recovery of a species population).[51] Response lags are largely beyond the power of humans to control directly. They are inherent in ecosystems because complex systems respond to changes in management strategies, climate change, and other ecological shifts along a spectrum of time scales. For example, the amount of time it takes a species to recover from overexploitation will depend on a range of factors, such as its reproduction rate, availability of food, predators, and other factors.

Human actors do, however, have the capacity to influence *policy* lags. Reasons for extended lag times between identification of a problem and creation of a policy solution may include:

- Lack of the technical and scientific understanding necessary to define the problem and provide solutions;
- Lack of a common understanding of the issue among actors;
- Intransigence despite a unified understanding among actors;
- Intervening distractions that demote the issue on policymakers' lists of priorities.[52]

To reduce policy lag times, policymakers can institutionalize a method to periodically assess the status of the biological resources they are managing, quickly identify new threats, determine if existing policies are effectively providing for the sustainable management of the resource, and require changes as needed (for example, immediately closing a fishery upon determination that the fish stock is dropping dramatically).

It may be easier to incorporate review and adjustment requirements into regulatory frameworks, such as for licensing or permitting of activities impacting the environment, than to modify the underlying legal code. Regulations can be easily designed for adaptive capacity. In Kenya, for example, licenses may be suspended, modified, or revoked in a number of circumstances, including if "the project poses an environmental threat which *could not be reasonably foreseen* before the license was issued."[53] These types of provisions, sometimes referred to

---

51. *Id.* at 399. The authors suggest the term "policy lag" as a simpler term than "etiology lag," the term used by Smith.

52. *Id.*

53. Environmental (Impact Assessment and Audit) Regulations, Legal Notice 101, Reg. 28(2)(c) (2003) (Kenya), *available at* http://www.kenyalaw.org/environment/content/search_lok.php?SearchTerm=Impact+Assessment+and+Audit (follow "The Environmental (Impact Assessment and Audit) Regulations 2003" hyperlink) (emphasis added).

as "re-opener clauses" because they can "open up" a previous approval or authorization for review and modification, provide important authority for managers to act adaptively and respond to circumstances different from those obtaining at the time of authorization.

At the legislative level, the adaptive approach to governance may require a somewhat deeper cultural predicate in order to be effective. It may be necessary to ask policymakers to commit to the proposition that there are limitations on the human ability to know in advance not only the conditions and challenges we will face in the future but whether and to what extent legal and policy efforts in the present will accomplish their intended goals.[54] Uganda's Law Reform Commission Act of 1990 presents a commendable example of an institutionalized framework for reviewing and updating laws and policies in light of new understandings and circumstances. The Law Reform Commission is charged with the task of, among other things, "development of new areas in the law by making the laws responsive to the changing needs of the society in Uganda . . . and the integration and unification of the laws of Uganda."[55] Although it has not apparently done so to date, such a body could undertake precisely the type of analysis suggested by this article to assess the capacity of a country's biological resource laws to respond to climate change.

C. IMPROVING INFORMATION MANAGEMENT, DISSEMINATION, AND USE

Adaptive management calls for decision-making frameworks that provide a holistic, ecosystem-level view of the resource issue in question, and utilize lessons learned from previous efforts. Too often, ministries and agencies charged with conserving natural resources operate in an environment of regulatory blindness or confusion that results from limited or vague definitions of management objectives, overlapping mandates, lack of information about what other authorities are doing, and lax accountability mechanisms.[56] Perhaps as a result of the legal language itself, the scale at which it is applied, the lack of capacity within resource agencies themselves, or due to some combination of these factors, managers rarely have the regulatory tools to comprehend the linkages between healthy ecosystems and the provision of other social and economic

---

54. This will no doubt be a tall order. But historical examples of national legislatures actively reviewing and responding to information on the efficacy and impact of laws governing biodiversity do exist. The U.S. Endangered Species Act underwent a series of revisions between 1969 and 1982 as the U.S. Congress actively sought to improve its ability to both protect species and accommodate human needs. *See* Alabama-Tombigbee Rivers Coalition v. Kempthorne, 477 F.3d 1250, 1264–67 (11th Cir. 2007).

55. Uganda Law Reform Commission Act, ch. 25, § 10 (1995) (Uganda), *available at* http://www.saflii.org/ug/legis/consol_act//ulrca284.

56. *See, e.g.*, Alyson C. Flournoy, *Protecting a Natural Resource Legacy While Promoting Resilience: Can it be Done?*, 87 NEB. L. REV. 1008, 1011–14 (2009) (describing how conflicting statutory mandates to both conserve natural resources for future generations and achieve multi-use objectives in the short term produce an excess of agency discretion exploitable by well-funded extractive industries).

services. In the context of adaptation to climate change, it is essential to recognize and integrate mutually-reinforcing policy objectives ("co-benefits").[57]

There is enormous need for improved cooperation and coordination across regulatory structures to move toward more coherent, rational, and effective environmental governance. The international community recognizes the importance of integrating multiple policy frameworks to effectively and consistently respond to synergistic, cross-cutting stressors like climate change. The Conference of the Parties to the Convention to Combat Desertification, for example, "[e]ncourages affected Parties to integrate sustainable land management issues within the UNFCCC national adaptation programmes of action,"[58] because land use choices made under one set of authorities directly affect the adaptive capacity of resources managed by other agencies. The Ramsar Convention's Strategic Plan for 2003–2008 calls on countries to "[e]nsure that wetland policies are fully integrated into and harmonized with other strategic or planning processes and documents, in particular those related to biodiversity, desertification, climate change, agriculture, trade in endangered species, water resource management, integrated coastal zone management and environmental planning in general, including national strategies for sustainable development."[59] National governments, however, have struggled to use existing legal tools such as strategic environmental assessment (SEA) authorities to integrate environmental policies across regions and sectors.[60]

There are examples of forward-looking attempts at integrated, holistic management of biological resources that can be built upon in responding to climate change. In May 2008, Vietnam's prime minister issued a decision "Approving the Scheme on the Protection of Endangered Precious and Rare Aquatic Species to 2015, and Vision to 2020" (the "Scheme").[61] Importantly for long-term adaptive management, the preamble of the decision requires that "protection of endangered . . . aquatic species must be based on a regularly updated scientific

---

57. *See* SECRETARIAT OF THE CONVENTION ON BIOLOGICAL DIVERSITY, TECHNICAL SERIES NO, 41, CONNECTING BIODIVERSITY & CLIMATE CHANGE MITIGATION & ADAPTION: REPORT OF THE SECOND AD HOC TECHNICAL EXPERT GROUP ON BIODIVERSITY AND CLIMATE CHANGE 43–44, tbl. 2.3 (2009), *available at* http://www.cbd.int/doc/publications/cbd-ts-41-en.pdf (listing "ecosystem-based adaptation measures that provide co-benefits").

58. Conference of the Parties to the Convention to Combat Desertification, Nairobi, Kenya, Oct. 17–28, 2005, *Report of the Conference of the Parties on its Seventh Session*, *Addendum: Part Two, Action Taken by the Conference of the Parties at its Seventh Session*, Decision 12/COP.7, para. 7, U.N. Doc. ICCD/COP(7)/16/Add.1, at 35 (Nov. 25, 2005), *available at* http://www.unccd.int/cop/officialdocs/cop7/pdf/16add1eng.pdf.

59. Conference of the Contracting Parties to the Convention on Wetlands, Valencia, Spain, Nov. 18–26, 2002, *Ramsar Strategic Plan 2003–2008*, Objective 2.1.2, *available at* http://www.ramsar.org/pdf/key_strat_plan_2003_e.pdf (last visited Mar. 29, 2010).

60. *See* ORGANIZATION FOR ECONOMIC CO-OPERATION & DEVELOPMENT (OECD), APPLYING STRATEGIC ENVIRONMENTAL ASSESSMENT: GOOD PRACTICE GUIDANCE FOR DEVELOPMENT CO-OPERATION 87 (2006), *available at* http://www.oecd.org/dataoecd/4/21/37353858.pdf (noting the importance of SEA in development planning for climate change).

61. Prime Minister's Decision 485/QD-TTg, Official Gazette Issue Nos. 03-04, at 30 (May 2, 2008) (Vietnam), *available at* http://faolex.fao.org/docs/pdf/vie82056.pdf.

groups,"[62] and calls for the fisheries sector to be developed sustainably.[63] The Scheme's objective is to limit threats to aquatic species "in a community-participatory approach."[64] During 2008–2010, the Scheme establishes a database system that lists precious and rare aquatic species and their biological and ecological characteristics and distribution.[65] Further, the Scheme establishes a system of "operation zones" of protection in inland water reserves for threatened, endemic aquatic species.[66] These zones are to be "buil[t] on an experimental basis" and are region-specific.[67] For example, eel species, especially *Anguilla marmorata* located in the lower stretches of the Ba and Huong Rivers, are managed under a special plan.[68] The Ministry of Agriculture and Rural Development and provincial/municipal People's Committees are responsible for implementation, with funding provided by the central government.[69] During 2011–2015, the goals include, for example, setting up annual programs to monitor changes in rare aquatic species in all catchment basins, establishing fifteen zones under local management, and setting up a roadmap for a responsible system of fishing and trade governed by the rule of law.[70]

Importantly, the Scheme is not a law itself, nor does it implement just one regulatory program; rather, it is a long-term, master project that consists of and consolidates many smaller, more specific targets that all operate to achieve a final result.[71] Each provincial agency, depending on its responsibilities, implements the Scheme following its existing legal framework, which is interpreted broadly enough to allow for participation in the management project. In other words, the Scheme grows out of and synthesizes the existing laws. This is an example of how a government can avoid the "stove piping" effect in which each ministry or agency perceives itself as responsible only for those items that are within its authority under a single law or group of laws. Here, instead, we see a centralized program that authorizes and calls upon a diverse array of agencies and levels of government (local, state, and national) to coordinate activities to implement a single, overarching management scheme for aquatic biological resources. While the results of this arrangement are still forthcoming, this may prove to be an ideal model for coordinated government policies to respond to climate change.

For adaptive management on this scale to be implemented effectively, how-

62. *Id.*
63. *Id.*
64. *Id.*
65. *Id.* at 31.
66. *Id.*
67. *Id.*
68. *Id.*
69. *Id.* at 34.
70. *Id.* at 32.
71. E-mail exchange with Hanh Vu Thu, Deputy Dean of Economics Law Faculty, Hanoi University of Law (Sept. 17, 2009).

ever, governing agencies and officials may need to share information they would rather not and acknowledge and learn from past failures.[72] From a structural governance perspective, this points to the lynchpin role of non-governmental actors, as well as courts, in broad-scale adaptive approaches to climate adaptation in resource management. NGOs, businesses, and other non-government entities with an incentive to improve sustainable management of resources can target their efforts (e.g., through citizen suit public-interest litigation) toward an improved learning function within resource agencies.[73]

Although not explicitly attuned to this purpose, a lawsuit filed by the Bangladesh Environmental Lawyers Association (BELA) provides insight into the importance of civil society's role in circumstances where resource agencies are unable or unwilling to recognize increased risks and vulnerabilities resulting from uncoordinated decision making. In 2003, BELA alleged that roughly 2,100 acres of critical mangrove habitat on Sonadia Island were being illegally converted for shrimp cultivation as a result of an "administrative vacuum" created by government officials.[74] In 1999, the island had been declared an "Ecologically Critical Area" (ECA) under Bangladesh's Environmental Conservation Act of 1995, in part because it provides a critical buffer zone against climate-driven storm surges.[75] Efforts were undertaken to restore the area: "[T]he coastal afforestation done in the newly accreted char lands of the coastal belts including the land of Sonadia Island was needed to protect and preserve the char land from erosion and also to save the country-side areas and people living therein from being inundated and swept by the tidal bore during natural disaster."[76] (A 2003 study notes that "sea level rises of up to 43 cm are expected by 2050 and more frequent and extensive cyclones and tidal effects are expected" in the region.[77])

Soon after the ECA declaration, however, another ministry declared the area a "reserve forest" under the Forest Act of 1927, resulting in the removal of ECA designation.[78] Procedures for registration as a "reserve forest" were not com-

---

72. *See* Holly Doremus, *Precaution, Science, and Learning While Doing in Natural Resource Management*, 82. WASH. L. REV. 547, 571 (2007) ("Unless learning is systematically rewarded by the legislature or the highest levels of the executive branch—which is rare—there is little external incentive for agency leaders to buck [a tradition of perpetuating ignorance].").

73. *See id.* at 573–79 (comparing litigation with potential learning components in Ecology Ctr. v. Austin, 430 F.3d 1057 (9th Cir. 2005) and Sierra Club v. Marita, 46 F.3d 606 (7th Cir. 1995)).

74. Bangl. Envtl. Lawyers Ass'n v. Sec'y, Ministry of Env't & Forest, para. 16 (Writ Petition . . . of 2003) (Bangl. Sup. Ct. High Ct. Div. 2003) [hereinafter Petition], *available at* http://www.elaw.org/node/2452.

75. *Id.* at paras. 5–6, 8.

76. *Id.* at para. 21.

77. MD. ABDUL MANNAN, PLANT BIODIVERSITY MANAGEMENT AT SONADIA ISLAND ECA (Dec. 2006) (draft at 21), http://www.undp.org.bd/projects/prodocs/CWBMP/Plant%20Biodiversity%20Management%20At%20Sonadia%20Island%20ECA.pdf (internal citation omitted).

78. Petition, *supra* note 74, at paras. 14–15.

pleted, however,[79] yielding an administrative loophole that allowed local elites in collaboration with government officials to clear much of the mangroves.[80] BELA's petition emphasizes that the situation presents "a classic example of conflicting and overlapping jurisdiction of authorities that [is] aggravate[d] due to [a] lack of interagency coordination, [which is] taking [its] toll [on] nature, natural resources and people dependant on such resources."[81] This petition serves as a cautionary tale about the need for both recognition of mutually reinforcing ecological and developmental objectives and the ease with which bureaucratic structures can hinder the achievement of those objectives in the absence of mandates for their integration in policymaking. But it also highlights the effective role courts and civil society can play in moving resource agencies to a more holistic management approach that considers broad-scale concerns like increased exposure to natural disasters due to coastal deforestation.

IV. INCORPORATING CLIMATE CHANGE IN ENVIRONMENTAL IMPACT ASSESSMENT

Environmental impact assessments (EIAs) have a potentially significant role in guiding decision makers toward sustainable adaptive management of projects exploiting biological resources. Realizing this role will increasingly require EIA drafters, proponents, and reviewing officials to account for climate change in considering both the viability and cost of an EIA project, as well as its effects on the regional ecology. Requirements to undertake EIAs are now included in treaties on both climate change and biodiversity protection.[82] The UNFCCC calls on parties to "[t]ake climate change considerations into account . . . in their relevant social, economic and environmental policies and actions," including the use of EIAs to reduce "adverse impacts on the economy, on public health and on the quality of the environment."[83] Article 14 of the 1992 Convention on Biological Diversity provides that a contracting party "shall [i]ntroduce appropriate procedures requiring environmental impact assessment of its proposed projects that are likely to have significant adverse effects on biological diversity with a view to avoiding or minimizing such effects."[84] The U.N. Convention on the Law of the Sea and the U.N Convention to Combat Desertification contain similar provisions.[85] The *Paris Declaration on Aid Effectiveness* states that the

79. Petition, *supra* note 74, at para. 14.

80. Petition, *supra* note 74, at para. 23.

81. Petition, *supra* note 74, at para. 28.

82. Julie A. Lemmer, Note, *Cleaning up Development: EIA in Two of the World's Largest and Most Rapidly Developing Countries*, 19 GEO. INT'L ENVTL. L. REV. 275, 279–80 (2007).

83. United Nations Framework Convention on Climate Change art. 4.1(f), May 9, 1992, S. TREATY DOC. NO. 102-38 (1992), 1771 U.N.T.S. 107.

84. Convention on Biological Diversity art. 14.1(a), June 5, 1992, 1760 U.N.T.S. 79.

85. United Nations Convention on the Law of the Sea art. 206, Dec. 10, 1982, 1833 U.N.T.S. 397; U.N. Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa art. 10(4), Oct. 14, 1994, 33 I.L.M. 1328, 1954 U.N.T.S. 3.

"progress [in use of EIAs] needs to be deepened, including on [sic] addressing implications of global environmental issues such as climate change, desertification and loss of biodiversity."[86]

One of the values of EIA laws for climate adaptation is that they generally define the "environment" and "project impacts" broadly enough that the existing language can be interpreted to require consideration of regional climate change effects, even if climate analysis is not expressly required. Although EIA laws can differ significantly between countries, there are generally at least two points at which authorities can determine whether or not to undertake a full analysis of the relationship between a development project and climate change: (1) in determining whether an EIA is needed at all; and (2) in setting the scope of analysis of an EIA. Generally, officials make an initial determination that a project will affect the environment before requiring an EIA for it. Under Uganda's 1995 EIA law, for example, before requiring an EIA, a determination must be made that a project "may have an impact on the environment," "is likely to have a significant impact on the environment," or "will have a significant impact on the environment."[87] Using this language, Ugandan authorities could give some attention at this stage to the possible effects of climate change. A finding that climate change will alter the environmental characteristics of a project, either by making it more costly, non-viable, or compounding its environmental impact, could, on its own, be sufficient to require an EIA.

If officials determine that an EIA is necessary, those preparing the EIA would then need to undertake a more rigorous analysis of the appropriateness of the project given climate change impacts. Uganda's law requires officials to design EIAs that are "appropriate to the scale and possible effects of the project."[88] After scoping a project in this way, giving due consideration to possible climate change interactions with the project, a list of questions, factors, or issues can be generated for structured analysis. For example, assume that an EIA is required for a new chemical processing facility in a stable geographic region. The chemicals processed at the facility could indeed have significant environmental impacts, but there may be only a very low probability that climate change will affect the viability or risks associated with that facility. In such a case an EIA that does not give extended treatment to climate change may be appropriate. However, if that same facility is proposed for construction in a coastal flood plain, the EIA should absolutely consider the risks to the surrounding environment posed by the facility itself and also the risks posed by the facility's impacts on the environment in the case of sea-level rise, coastal erosion, flooding, storm surges, and other extreme

---

86. OECD, PARIS DECLARATION ON AID EFFECTIVENESS: OWNERSHIP, HARMONISATION, ALIGNMENT, RESULTS AND MUTUAL ACCOUNTABILITY para. 40 (2005), *reprinted in* THE PARIS DECLARATION ON AID EFFECTIVENESS AND THE ACCRA AGENDA FOR ACTION, at 7 (2008), *available at* http://www.oecd.org/dataoecd/11/41/34428351.pdf.

87. National Environment Statute, § 20(3), No. 4 (1995) (Uganda).

88. *Id.* § 20(5).

weather events (e.g., possible release of toxic chemicals into the environment due to flooding).

Policymakers may need to examine existing language in EIA laws to determine the laws' capacity to both include and respond to long-term climate change and its effects on biological resources in the context of an EIA project. For example, Annex 3 of Bhutan's Regulation for the Environmental Clearance of Projects of 2001 requires all environmental assessment reports (EAR, the Bhutanese term for EIA) to consider the "*potential* environmental, economical and social impacts of the proposal."[89] Although it does not mention climate change per se, the requirement to look at "potential" impacts of a project could be sufficient to require climate change to be considered in an EAR. Further, this law requires EARs to describe the "existing environment" in order to establish a baseline against which the project's impacts and mitigation measures can be assessed.[90] As discussed above, the identification of baselines is an essential step in adaptive governance. On the other hand, establishing a baseline based on the "existing environment" only and without regard to how that environment may have already changed and how it will change under future climatic scenarios may not give decision-makers a full understanding of the environmental context of projects in the longer-term.

Other requirements in Bhutan's law may close this gap. Impact assessment must include "direct and indirect *potential* environmental impacts from *all* aspects of the project" as well as "long-term impacts for all phases of the project . . . and cumulative impacts of the project, any other projects, and other work or activity in the immediate surroundings and region."[91] The sheer breadth of this language may be sufficient to incorporate relevant effects of climate change on project viability, cost, or impact within the EAR analysis. However, literal-minded or overworked officials may still be inclined to read this language narrowly as only requiring cumulative impacts of other human activity in the region and not necessarily or expressly calling on project proponents to take a hard look at the synergies between project activities and climate change. Bhutan's law might also be interpreted to require evaluation of long-term climate change effects through mitigation measures, which require an "implementation schedule that shall ensure that mitigation measures shall be implemented prior to or when appropriate in relation to environmental impacts."[92] This "schedule" introduces a temporal element into impact analysis and mitigation, perhaps providing the implicit authority to recognize and mandate adjustments in response to a project's changing ecological context.

Policymakers should recognize that those overseeing EIA projects require

89. Regulation for the Environmental Clearance of Projects, Annex 3 (2001) (Bhutan) (emphasis added).
90. *Id.* § 7.
91. *Id.* § 8 (emphasis added).
92. *Id.* § 9.

regulatory tools to continue monitoring climate change synergies with projects after the initial authorization is made, and to review and revise EIAs if it becomes clear that climate change (or some other future ecological disturbance) undermines beliefs about the "existing environment" upon which the initial authorization was premised. The EIA process will work most effectively as an adaptive measure for climate change when authorities retain oversight and significant powers for review and adjustment of a project well after its initial authorization.

V. ASSESSING GOVERNANCE CAPACITIES AT MULTIPLE SCALES AND FOSTERING ADAPTIVE INDIGENOUS AND COMMUNITY-BASED RESOURCE GOVERNANCE

The importance of public participation and the role of indigenous and local communities have emerged as essential components of climate adaptation.[93] A decentralized or community-based approach to biological resource management may increase capacity to respond to climate change impacts through more informal and immediately responsive decision-making structures than centralized administrative procedures.[94] Conventional models of centralized resource management may not be effective at utilizing information networks and can actually inhibit public learning in dynamic ecological settings.[95] In its strongest form, this critique emphasizes the lack of adaptability and emphasizes the

---

93. The Convention on Biological Diversity calls on parties "when addressing research needs and activities on the impacts of climate change on biodiversity, to involve indigenous and local communities and other relevant stakeholders, particularly on issues related to ecosystem health, human health, traditional knowledge, and livelihoods." *Conference Decision* VIII/30(1), *supra* note 32, at para. 3.

94. One must cabin this statement, and indeed this entire section, with a caution that decentralization of resource management can also result in *more* degradation of the environment and weaker, less democratic governance than centralized control. This might suggest an "adaptive" approach to devolutionary schemes to ensure they achieve intended objectives and provide mechanisms to adjust or reverse course if they are not. *See generally* JESSE C. RIBOT, WAITING FOR DEMOCRACY: THE POLITICS OF CHOICE IN NATURAL RESOURCES DECENTRALIZATION (World Resources Institute 2004) (discussing strategies for sustaining decentralized institutions). Generally, communities are thought to use common-pool resources sustainably when social rules exist that establish clear geographic boundaries, limits to usage type, and appropriate consequences for overuse. James Sanderson et al., *Escaping the Minimalist Trap: Design and Implementation of Large-Scale Biodiversity Corridors*, *in* CONNECTIVITY CONSERVATION 621, 636–38 (Kevin R. Crooks and M. Sanjayan eds., 2006). A recent study that reviewed community-based resource management initiatives in southern Africa concluded that sustainable conservation could be achieved under the following conditions: maintenance of a diverse and flexible range of livelihood options; maintenance or improvement of the production potential of the resource base; effectively functioning institutions for local governance and resource management; economic and other benefits to incentivize sustainable use of the resource; implemented policies and laws that are effective, with the authority to apply them handed down to the lowest capable level; responsible external facilitation; and local-level power relations favorable to community-based resource management. G.P. Von Maltitz et al., *Adapting Conservation Strategies to Accommodate Impacts of Climate Change in Southern Africa* 27 (AIACC Working Paper No. 35, 2006).

95. *See* Karkkainen, *supra* note 40, at 206 ("[T]here is growing recognition that ecologically sound management must be local and/or regional in character, tailored to the ecosystem context. Because problems and solutions are not uniform across all ecosystems, management systems must be capable of generating locally tailored responses.").

obstacles to learning inherent to such systems.[96] Thus, empowering and fostering the governance capacity of small indigenous and local communities of resource users is emerging not only as a critical response strategy to climate change, but as a framework of governance some believe to be inherently more resilient to ecological change.

For example, Bolivia's National Climate Change Program was established to evaluate climate change vulnerability in indigenous communities living in the country's dry mountainous lands with the end goal of analyzing climate change effects in the region and working to create an adaptation scheme.[97] The program found that indigenous communities in Bolivia had recorded changes in the climate through the observation of modifications in animal behaviors and plants over multi-year periods and had predicted from these observations how their food, bioresources, and farming patterns would be affected. Fifty percent of the population identified drought as a major issue as opposed to ten years prior, when 70 percent stated it was not a major issue.[98] This survey demonstrates at a minimum that local communities are capable of monitoring observed changes in their environments resulting from climate change.

Communities can, however, contribute even more to adaptation efforts. The Watershed Protection Program established by the Honduran government and the Food and Agriculture Organization (FAO) demonstrate that local knowledge can translate directly into scalable adaptation strategies. The remote village of Guarita was one of a few Honduran villages that did not lose its entire crop to Hurricane Mitch in 1998.[99] Investigations later revealed that the people of Guarita used traditional Quezungal farming methods, which provided protection against the hurricane's effects while other farming methods taught in agriculture colleges and practiced in neighboring regions were ill-suited for the terrain, leaving crops vulnerable to total failure in the face of a single severe weather event.[100] Because of its success, the Quezungal method was selected for promotion around the country by the Honduran government in collaboration with the

---

96. *See* Claudia Pahl-Wostl, *A Conceptual Framework for Analysing Adaptive Capacity and Multi-level Learning Processes in Resource Governance Regimes*, 19 GLOBAL ENVTL. CHANGE 354, 358 (2009) ("[C]entralized political and economic systems, privatization and commercialization of environment, rigid bureaucratic systems and political secrecy and poor access to information impedes social learning." Citing J. Tippet et al., *Social Learning in Public Participation in River Basin Management–Early Findings from HarmoniCOP European Case Studies*, 8 ENVTL. SCI. & POL'Y 287, 293 (2005)).

97. *See* PROGRAMA NACIONAL DE CAMBIOS CLIMATICOS BOLIVIA, REPUBLICA DE BOLIVIA, VULNERABILIDAD Y ADAPTACION AL CAMBIO CLIMATICO EN LAS REGIONES DEL LAGO TITICACA Y LOS VALLES CRUCEÑOS DE BOLIVIA 2 (2006), *available at* http://www.nlcap.net/fileadmin/NCAP/Countries/Bolivia/Bolivia_V_A_REPORT01-02-06.pdf.

98. *Id.* at 44.

99. INT'L UNION FOR CONSERVATION OF NATURE, VISION FOR WATER AND NATURE: A WORLD STRATEGY FOR CONSERVATION AND SUSTAINABLE MANAGEMENT OF WATER RESOURCE IN THE 21ST CENTURY 36 (2000), *available at* http://www.rivernet.org/general/docs/VisionWaterNature.pdf.

100. *Id.*

FAO.[101] This experience demonstrates that traditional knowledge can prove invaluable in developing adaptive strategies for climate change. It further shows that the support of a national government in partnership with an NGO or international organization to use adaptation techniques based on traditional knowledge has at least three benefits: protecting biological resources (in this case, crops); legitimizing and fostering a base of traditional knowledge; and providing a method for sharing information about effective strategies to other regions and communities.

Indigenous communities may be equipped to take on the full suite of management functions called for in climate-adaptive governance. Recent field research demonstrates how communities in the Inner Niger Delta area of the Sahelian zone of Mali have developed sophisticated resource management structures to respond to the severe climatic shifts that have already occurred in this region over the twentieth century.[102] The effective management response that the communities have organized bears important lessons for climate-adaptive resource governance elsewhere. These structures for resource governance are "polycentric" in nature[103]—they "permit communities of resource users to self-organize at scales appropriate to the nature of collective action problems."[104] The researchers documented numerous examples of flexible yet enforceable resource management strategies through the use of traditional rules and systems of checks and balances, and cooperative inter-village and regional planning.[105] In any region where strong indigenous or traditional communities exist, local institutions and practices should be thoroughly investigated and understood before decisions on climate adaptation needs are made by outside authorities. It may be that these regimes are effectively providing climate-resilient resource management that a top-down governance approach would have difficulty replicating.

Likewise, in natural resource management situations in which the government

---

101. *Id.*

102. Charles E. Benjamin, *From Action Spaces to Polycentric Governance: Livelihoods and Natural Resource Institutions in Mali* (submitted to AFRICA J. OF THE INT'L AFRICAN INST., Sept. 12, 2009; on file with ELI).

103.

> [P]olycentric governance systems are defined here as complex, modular systems where differently sized governance units with different purpose, organization, [and] spatial location interact to form together a largely self-organized governance regime. Polycentric governance systems are characterized by many degrees of freedom at different levels. Multi-level governance in polycentric systems implies that decision making authority is distributed in a nested hierarchy and does not reside at one single level . . . .
>
> From a normative point of view it is of major interest that polycentric systems are assumed to have a higher ability to adapt to a changing environment and to be less affected in their integrity by sudden changes or failure in parts of the system.

Pahl-Wostl, *supra* note 96, at 357.

104. Benjamin, *supra* note 102, at 11.

105. *Id.* at 19–27.

maintains a strong regulatory role, the challenges climate change poses to managing both officials and resource users require increased trust, communication, and cooperation. Policymakers should consider whether legal frameworks encourage and enable this collaboration or present barriers to it. For example, Liberia's framework environmental law establishes the environmental agency as a "clearinghouse" of environmental conventions and agreements with the responsibility to "coordinate activities related to these instruments in Line Ministries, State agencies, and non-governmental organizations."[106] The agency is also empowered to gather information on the environment and natural resources, analyze that data, disseminate information to private and public users, exchange information with various actors, and give advice on existing information gaps and needs to other government organs.[107] Thus the agency has an information-support role, distinct from its activities carrying out regulatory mandates, that is more likely to attract engagement by resource users and other non-governmental entities.

Non-regulatory service provision builds the capacity to manage ecosystems holistically by cutting across bureaucratic categories and providing a supporting government role in assisting resource users that is not directly regulatory in nature. For example, research on fishing communities on the Rio de la Plata in South America found maladaptive, over-exploitative behaviors from fishermen due to uncertainties resulting from climate variability.[108] The most immediate governance need was not, in the view of the researchers, more stringent regulation—which would only further the break-down in trust between managers and resource users—but rather an "Adaptation Control Information System," to allow for collaborative, adaptive management between stakeholders and agencies prioritizing "integration of local and scientific knowledge, training, enhancement of data collection systems, weather and climate forecasting, and real-time communication to users."[109] Similar information and coordination needs in response to climate impacts could likely be identified in resource-user communities around the world.

Adaptive collaborative models invert the traditional command-and-control approach to resource protection in which information sharing and cooperation are anemic because they take place against a predetermined backdrop of criminal and civil penalties and exposure to liability. Rather, the co-management model builds rules and mandates upon a foundational community of practice fortified by trust and mutually agreed-upon values, interests, and goals. It is not that there are no rules in the collaborative governance model; it is that enforcement of the rules

---

106. Environment Protection and Management Law, § 99(3) (2002) (Liber.).

107. *Id.* § 100(1).

108. Gustavo Nagy et al., *Adaptive Capacity for Responding to Climate Variability and Change in Estuarine Fisheries of the Rio de la Plata* 8 (AIACC Working Paper No. 36, 2006).

109. *Id.* at 13.

becomes the rare exception to compliance voluntarily offered and intrinsically understood.[110]

VI. REFOCUSING WILDLIFE POLICIES AROUND RESILIENT MATRICES OF DIVERSE ECOSYSTEMS

Climate change poses an enormous challenge for the global network of protected areas (both land-based and marine) as it exists today. Several studies suggest that the existing network of protected areas will not be sufficient to conserve significant percentages of the world's biodiversity as the changing climate and various human activities degrade existing habitats.[111] It is no doubt true that quantitative expansion of protected acreage is a priority for biodiversity protection in response to climate change. While the simple establishment of new protected areas, parks, or reserves may not present a particularly rich field for legal scholarship, there are nonetheless some legal concerns that deserve attention and past mistakes that must be avoided.

Protected areas have been selected opportunistically rather than strategically and designed on the assumption that if a reserve can be kept free of human influence, resident species will naturally adapt there to changing conditions as they have in the past. But protected areas can no longer be managed primarily by sealing the borders to human development and allowing nature to run its course.[112] When localized climatic conditions exceed the range that a species can tolerate, that species will move if able,[113] and protected areas located and sized based on the historic ranges of flora and fauna will become ineffective. Conversely, failing to consider the economic needs of resident human populations threatens the political viability of protected areas and may reduce socio-economic capacities to adapt to climate change.[114] Climate change negates the notion that discrete areas can be set aside as "reserves" while the rest of the

---

110. *See* Bradley C. Karkkainen, *"New Governance" in Legal Thought and in the World: Some Splitting as Antidote to Overzealous Lumping*, 89 MINN. L. REV. 471, 486–87 (2004) ("[M]ost New Governance scholars acknowledge the necessity for some or many forms of 'hardness' in law, and would deviate from that, if at all, only by admitting 'softness' in one or a few aspects of the legal regime they envision. . . . [N]egotiated rulemaking . . . [is] not about 'softness' at all. Instead, [it provides] alternative, consensual or consent-based procedures for arriving at conventionally 'hard'—that is, fixed, definite, formal, ultimately coercive, enforceable and enforced—regulatory rules.").

111. PATTY GLICK ET AL., A NEW ERA FOR CONSERVATION: REVIEW OF CLIMATE CHANGE ADAPTATION LITERATURE 14–15 (2009).

112. *See* Pierre Bernier & Dieter Schoene, *Adapting Forests and their Management to Climate Change: An Overview*, 60 UNASYLVA 231/232, at 5, 7 (2009).

113. GLICK, *supra* note 111, at 15; Reed F. Noss, *Beyond Kyoto: Forest Management in a Time of Rapid Climate Change*, 15 CONSERVATION BIOLOGY 578, 581 (2001).

114. *See* DILYS ROE & MARGARET JACK, EVALUATING EDEN SERIES NO. 9, STORIES FROM EDEN: CASE STUDIES OF COMMUNITY-BASED WILDLIFE MANAGEMENT 19 (2001), *available at* http://www.cites.org/eng/prog/economics/Evaluating_Eden.pdf (finding significant economic costs to local pastoralists and farmers resulting from establishment of the Lake Mburo National Park in Uganda).

landscape is fragmented, but it also raises concerns about ensuring human welfare and livelihoods dependent on wide mobility to reach natural resources.[115] This strongly suggests a need to re-envision conservation through protected areas in terms of a landscape-level matrix that combines core habitats, corridors, and mixed-use or human-occupied areas to give species a wide range of movement[116] while simultaneously accommodating human needs.[117]

Climatic threats to protected habitats will include altered hydrological cycles and a prevalence of pioneer species and "cosmopolitan" species (those that are widespread around the globe and can outcompete specialized endemic species). The varying paces at which species will be able to seek out more suitable habitats, if able, will create new species-community compositions and novel habitat arrangements.[118] Evidence from studies of past climate variability suggests that as the regional climate shifts, species will migrate individualistically rather than as communities.[119] Many species may require intervention to adapt to changing conditions.[120] Some will experience a complete loss of suitable habitat either because of geographic limitations (such as the resplendent quetzal in Costa Rican cloud forests that has no higher elevation to move to) or because of extensive human modification of the landscape around climate-impaired habitat. Such species may need to be translocated (also known as "assisted migration"[121]) to ex situ natural or man-made habitats.[122] Ultimately, the end goal cannot be to conserve species communities as they exist today, but to conserve *centers of evolution* and *pathways of migration* in and by which new ecosystems can form

---

115. *See* J.J. HOPKINS ET AL., CONSERVING BIODIVERSITY IN A CHANGING CLIMATE: GUIDANCE ON BUILDING CAPACITY TO ADAPT 15 (2007).

116. An additional layer of complexity is presented by potentially increased opportunities for movement of invasive species. Invasive species and diseases that are adaptable to changing climatic conditions may expand their reaches, posing a serious threat to already-weakened populations of native species with more limited tolerance for change in climatic conditions. S. Mansourian et al., *The Role of Forest Protected Areas in Adaptation to Climate Change*, 60 UNASYLVA 231/232, at 63, 63–64 (2009).

117. *See* Nigel Dudley and Sue Stolton, *Ecological and Socioeconomic Benefits of Protected Areas in Dealing with Climate Change*, *in* BUYING TIME: A USER'S MANUAL FOR BUILDING RESISTANCE AND RESILIENCE TO CLIMATE CHANGE IN NATURAL SYSTEMS 217, 229 (L.J. Hansen et al. eds., 2003), *available at* http://assets.panda.org/downloads/8chapter8.pdf.

118. *See* David Welch, *What Should Protected Areas Managers do in the Face of Climate Change?*, 22 GEORGE WRIGHT FORUM 75, 79 (2005).

119. L. Hannah et al., *Climate Change-Integrated Conservation Strategies*, 11 GLOBAL ECOLOGY & BIOGEOGRAPHY 485, 488 (2002).

120. *See* Scott R. Loarie et al., *The Velocity of Climate Change*, 462 NATURE 1052, 1052 (2009) ("For species to survive, the persistence of suitable climates is not sufficient. Species must also keep pace with climates as they move.").

121. Julie Lurman Joly & Nell Fuller, *Advising Noah: A Legal Analysis of Assisted Migration*, 39 ENVTL. L. REP. 10413, 10414 (2009) ("While scientists debate the ecological utility of [assisted migration], some have also recognized that the current legal framework may be an additional obstacle to assisted migration.").

122. *See* Noss, *supra* note 113, at 586; Philip E. Hulme, *Adapting to Climate Change: Is There Scope for Ecological Management in the Face of a Global Threat?*, 42 J. APPLIED ECOLOGY 784, 791 (2005).

and reassemble.[123] Policymakers will need to rethink in holistic terms the purposes underlying protected areas networks.

Some biodiversity conservationists have proposed that conservation officials be given the legal authority to modify the existing network of protected areas as bioclimatic conditions change.[124] There are at least two concerns with this approach. First, this simply may be politically impossible to carry out in practice. The administrative requirements of decommissioning and establishing new protected areas over the landscape as the climate changes would be burdensome, costs of buying out landowners would be high, and it would be socially unpalatable to deal with the high levels of uncertainty associated with fluctuating protected area statuses. Second, flexible authority to shift protected area boundaries poses an enormous risk of abuse; areas may be decommissioned to make way for land development rather than to allow establishment of new, more climate-resilient areas elsewhere.[125]

To the extent governments are able to go forward with creating new protected areas, one method of achieving some flexibility is to provide for the creation of temporary protected areas in anticipation of establishing more permanent ones. This approach is currently provided in Madagascar's regulations on establishing protected areas and is expressly authorized to avoid resource degradation during the administrative process for creating the area.[126] Such authorities could be reinterpreted or adapted to allow for creation of temporary reserves or scientific evaluation areas to determine whether the area is likely to provide significant biodiversity or ecosystem benefits over the long-term and in the face of climate change. Rather than a fluctuating "kaleidoscope" model of area conservation, then, policymakers should be working toward creating connected, more permanently established networks of protected areas (containing various levels of human settlement and access to natural resources as appropriate) resulting in a resilient "matrix" of diverse ecosystems across the whole landscape.[127] The remote Himalayan Kingdom of Bhutan's efforts in this regard are noteworthy. In accordance with a constitutional requirement to keep "a minimum of sixty percent of Bhutan's total land . . . maintained under forest cover for all time,"[128] the country has embarked on an ambitious agenda that by 2009 had designated

---

123. *See* Peter Kareiva & Michelle Marvier, *Conserving Biodiversity Coldspots*, 91 AM. SCI. 344, 348–49 (2003).

124. *See, e.g.*, Von Maltitz, *supra* note 94, at 11–12.

125. *See, e.g.*, Yasiin Mugerwa & Jude Luggya, *Uganda: Govt to Give Away Nine More Forests*, MONITOR, Jan. 6, 2007, *available at* http://www.illegal-logging.info/item_single.php?it_id=1896&it=news (quoting official claiming Uganda's forest law permits decommissioning of forests at the request of local communities for land development).

126. Decree no. 2005-848 arts. 12–15 (2005) (Madagascar).

127. *See* Hannah et al., *supra* note 119, at 492 (noting that as climate change shifts habitat conditions, matrix lands may replace protected areas as primary habitat, in which case matrix management will become a key method for preventing massive loss of species).

128. THE CONSTITUTION OF THE KINGDOM OF BHUTAN art. 5(3).

48.5 percent of its land under some level of protected-area status.[129] By 2009, six protected areas were operational with four more planned by 2013.[130] These are connected by "Biological Corridors" covering 9 percent of Bhutan's land area.[131] The country's Nature Conservation Division has consolidated these areas into a "macro-level natural landscape called the 'Bhutan Biological Conservation Complex.'"[132] In this model the individual protected areas are conceived as "building blocks" of landscape conservation rather than as discrete, isolated units.[133]

Policymakers should seek to intelligently design protected area networks targeted to those sites that will remain or become viable centers of evolution and pathways of migration under a range of long-term climate scenarios.[134] The emerging field and improving technology of regional-scale bioclimatic modeling will provide policymakers the best scientific information on where these sites are located.[135] Nonetheless, basic principles of conservation biology, and even non-scientific observation by local residents, already provide a strong basis for prioritization. For example, "ecotones"—transition areas where natural physical barriers such as a high elevation zone, coastal zone, or a temperature or precipitation gradient mark the boundaries of multiple habitats or ecosystems—tend to house particularly high biodiversity concentrations as species from overlapping systems interact there. Policymakers should identify and prioritize climate adaptation efforts in these zones as they regulate and modify the flow of species between larger, more distant biomes; generate evolutionary diversity; and serve as repositories of genetic diversity to rehabilitate adjacent ecosystems when they lose species as a result of climate change.[136]

VII. BUILDING CLIMATE-RESILIENT, BIODIVERSITY-ENHANCING REDD PROJECTS

The future of international biodiversity conservation may well be transactional, not regulatory. If legal frameworks do not adapt to *this* change, even those

---

129. NATIONAL ENVIRONMENT COMMISSION, FOURTH NATIONAL REPORT TO THE CONVENTION ON BIOLOGICAL DIVERSITY 26 (2009) (Bhutan).

130. *Id.*

131. *Id.*

132. *Id.*

133. *Id.* at 71.

134. *See* AD HOC TECHNICAL EXPERT GROUP ON BIODIVERSITY AND ADAPTATION TO CLIMATE CHANGE, SECRETARIAT OF THE CONVENTION ON BIOLOGICAL DIVERSITY, CBD TECHNICAL SERIES NO. 25: GUIDANCE FOR PROMOTING SYNERGY AMONG ACTIVITIES ADDRESSING BIOLOGICAL DIVERSITY, DESERTIFICATION, LAND DEGRADATION AND CLIMATE CHANGE 8 (2006).

135. *See* BASTIAN BOMHARD & GUY MIDGLEY, SECURING PROTECTED AREAS IN THE FACE OF GLOBAL CHANGE: LESSONS LEARNED FROM THE SOUTH AFRICAN CAPE FLORISTIC REGION 31 (2005) (noting the importance of using regional-scale rather than global models).

136. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE WORKING GROUP II, CLIMATE CHANGE 2001: IMPACTS, ADAPTATION, AND VULNERABILITY para. 19.3.3.3 (Cambridge University Press, 2001).

attuned to *climate*-adaptive management will be at risk in the coming new order. While many forces are pushing governance in this direction, the single most important source of this paradigm shift may be a device called Reduced Emissions from Avoided Deforestation and Degradation (REDD). REDD is a climate change mitigation mechanism that seeks to achieve reduced greenhouse gas emissions through financial incentives to leave intact forests and other ecosystems that naturally store carbon. REDD is thus a type of payment for ecosystem services (PES) model in which the beneficiary is paid to preserve one or more ecosystem functions, in this case carbon sequestration. The 2009 Copenhagen Accord reached between major emitting countries includes REDD as a major action item.[137]

Several concerns need to be addressed to ensure that climate change *mitigation* efforts like REDD are consistent with and complement the management flexibility necessary for climate *adaptation* efforts. The existing mix of incentives does not currently ensure these twin policy objectives are pursued with equal vigor in such projects. For example, under the Kyoto Protocol (effective until 2012), developing countries do not have quantified emissions targets and thus are not required to produce records of national deforestation. This could result in a situation in which forests and their natural biodiversity are allowed to be destroyed so that countries can receive credits for "reforesting" the areas with monocultures.[138] Countries could also face a disincentive to incorporate adaptation co-benefits into the emission offset credits they sell if this would raise the price and discourage potential buyers.[139] For example, it may be that the most climate-resilient forests will be those that have been subjected to a regime of controlled burns (indeed, this may enhance carbon sequestration benefits as well), but a REDD pricing system that does not account for the benefits of an increase in emissions in the short-term to prevent catastrophic forest fires and concomitant carbon release in the long-term will fail both to mitigate climate change and to build ecosystem resilience.[140] The only way to learn whether

---

137. Conference of the Parties to the United Nations Framework Convention on Climate Change, Copenhagen, Denmark, Dec. 7–18, 2009, *Copenhagen Accord*, para. 6, FCCC/CP/2009/L.7 (Dec. 18, 2009), *available at* http://unfccc.int/resource/docs/2009/cop15/eng/l07.pdf ("We recognize the crucial role of reducing emission from deforestation and forest degradation and the need to enhance removals of greenhouse gas emission by forests and agree on the need to provide positive incentives to such actions through the immediate establishment of a mechanism including REDD-plus, to enable the mobilization of financial resources from developed countries.").

138. FRIENDS OF THE EARTH INTERNATIONAL, ET AL., *Introduction: Tree Plantations as Carbon Sinks: A Lose-Lose Option*, in TREE TROUBLE: A COMPILATION OF TESTIMONIES ON THE NEGATIVE IMPACT OF LARGE-SCALE MONOCULTURE TREE PLANTATIONS PREPARED FOR THE SIXTH CONFERENCE OF THE PARTIES OF THE FRAMEWORK CONVENTION ON CLIMATE CHANGE, *available at* http://www.wrm.org.uy/actors/CCC/trouble.rtf (last visited Mar. 29, 2010).

139. *See* NIKKI REISCH, SEEING THE FOREST FOR THE CARBON?: WORLD BANK BRINGS "MARKET-MAKING" TO TROPICAL FORESTS 10 (2007), http://www.bicusa.org/proxy/Document.10791.aspx.

140. *See* Noelle Straub, *Scientists Prescribe Controlled Burns to Protect Forests, Curb Emissions*, ENERGY

prescribed burns are effective may be through experimental adaptive management, but current REDD contracts likely do not provide that type of flexibility. Because REDD schemes can focus on carbon sequestration to the exclusion of other environmental processes, they could incentivize management trends toward monoculture "carbon farms" that undermine forest biodiversity and climate resilience.[141]

In order to ensure adaptation co-benefits, carbon sequestration should never be the sole objective of any natural-resource management area. REDD projects should only proceed if carbon can be pulled out of the atmosphere without weakening ecosystems' capacities to withstand climate change. In this respect, perhaps the easiest way to integrate sequestration initiatives with climate adaptation goals is to define qualified REDD or other carbon sequestration projects to exclude monoculture plantations.[142] It will be necessary to actively incorporate climate adaptation within REDD projects to ensure accurate reporting and a real accumulation of environmental benefits. The Climate, Community and Biodiversity Alliance (CCB) has created a voluntary mechanism that couples climatic and biodiversity goals. The CCB Project Design Standards certify projects that simultaneously address climate change, support local communities, and conserve biodiversity.[143] Consumer awareness through certifications, however, may not be enough to stimulate the level of focus on biodiversity that is required. Measures to build and sustain climate-resilience into sequestration projects should ultimately be incorporated into the terms and conditions of the legal instruments establishing REDD projects.[144]

CONCLUSION

Several years ago, law professor Bradley Karkkainen concluded a piece on collaborative ecosystem governance by asking several questions of his readers:

> At the macro-institutional scale, how do we move from a series of discrete local experiments to a larger and more robust coordinated system of collaborative ecosystem governance institutions, without losing the local, participatory, and experimental character that appears to be so critical to their success? Linkages among local experiments, central monitoring, systematic efforts to learn from and diffuse the most successful models (and to learn from the errors of the

---

& ENV'T NEWS, Dec. 1, 2009, http://www.eenews.net/eenewspm/2009/12/01/4 (quoting one researcher saying that "[a]rtfully managing rather than aggressively fighting wildfire will help minimize short-term carbon emissions and maximize long-term carbon storage.").

141. Andrew Long, *Taking Adaptation Value Seriously: Designing REDD to Protect Biodiversity*, 3 CARBON & CLIMATE L. REV. 314, 321 (2009).

142. *See* FRIENDS OF THE EARTH INTERNATIONAL, *supra* note 138.

143. Climate, Community & Biodiversity Alliance, The CCB Standards (2005), http://www.climate-standards.org/standards/index.html.

144. *See* Long, *supra* note 141, at 320.

> failures), and larger structures and mechanisms of accountability to the public at large are generally not well developed at this stage. What would those second-order institutional arrangements look like? How do we get there from here?[145]

The project of building institutional frameworks for adaptive management has indeed made progress in the intervening years. Examples throughout this article demonstrate that models of proactive, adaptive, accountable management can now be found throughout the developing world. We have also gained much wisdom into the background conditions of governance that enable this more resilient, sustainable approach to resource use, management, and protection. This article has largely been an exploration of emerging models for those "second-order institutional arrangements"—the laws—presented in the context of climate change's ominous imperatives. It must be left to policymakers, academics, and legal practitioners in their own countries to assess the "adaptive capacity" of their respective legal systems, to determine how much can be done within existing laws, and to discover how much more may be accomplished with new ones. It is hoped that this article can provide helpful guideposts for that analysis by laying out the core functions adaptive regimes can serve.

145. Karkkainen, *supra* note 40, at 243 (internal citation omitted).