Please contact goldman@eli.org with any comments or questions

LEGAL AND POLICY TOOLS TO ADAPT BIODIVERSITY MANAGEMENT TO CLIMATE CHANGE

Resource Manual

ENVIRONMENTAL LAW INSTITUTE

Final Draft

October 2010

Preface: The Climate Change Challenge for Biodiversity Governance

This resource manual is a call to use laws and regulations to adapt biodiversity management to the expected effects of climate change. Climate change will likely impact species and ecosystems that are already facing severe threats from invasive species, habitat degradation and fragmentation, overexploitation, and pollution. As climate change becomes more severe, gaps and weaknesses in existing legal frameworks and government policies are starting to appear. Current laws frequently assume or emphasize preservation of a status quo that may no longer be possible to maintain; they may impose burdensome requirements that do not advance rational policy objectives. Meanwhile, first efforts at adaptive management have tended to overlook the role of the law as a powerful adaptation tool.

This resource manual will help policymakers and stakeholders determine how their laws can be changed to meet these new policy objectives. Because the impacts of climate change are highly localized and uncertain, the manual is designed to offer a range of options for managing natural resources that can be adapted to a variety of contexts and capacities. Climate change presents an opportunity. We are at a moment when "longstanding and long-ossified legal and institutional arrangements over natural resources are destabilized, opening the door to new, creative, problem-solving approaches." [1]

Using the principles of adaptive, ecosystem-based management, the resource manual shows how legal frameworks, regulatory programs, and management plans can provide a more resilient approach for long-term, sustainable resource governance in the face of climate change. The resource manual focuses on *in situ* management types (e.g., forests, fisheries, protected areas), the sustainable use of natural resources, and conservation of biodiversity. The resource manual does not cover the agricultural sector and does not explicitly focus on genetic resources. However, many of the principles and the dynamic models of governance presented in the resource manual are relevant outside the context of biodiversity and natural resources management, and can be applied in many other areas of law and policy.

ELI staff was guided by an Advisory Committee of environmental practitioners in six countries: Peru, Dominican Republic, Uganda, Madagascar, Bhutan, and Vietnam. These countries have distinct ecological contexts, legal systems and political, social, and economic situations. Examples and illustrations have been drawn from these and other developing countries to demonstrate the feasibility of innovative legal programs for adaptation in countries with limited governance capacity. The resource manual was also reviewed by a many internationally respected experts on biodiversity and climate change issues. ELI is, of course, responsible for the final content, analysis, and recommendations.

[1] Bradley C. Karkkainen, *Getting to "Let's Talk": Legal and Natural Destabilizations and the Future of Regional Collaboration*, 8 NEV. L.J. 811, 822, 825 (2008).

How to Use the Resource Manual

The resource manual is intended for people who design or use laws and policies affecting biodiversity in countries with (i) a significant interest in protecting biodiversity in their ecosystems, (ii) high vulnerability to climate change, and (iii) moderate-to-high capacity for environmental governance. It provides two tracks of use:

(1) Options for creating new legal and policy frameworks to improve adaptive biodiversity governance for climate change; and

(2) Guidance for handling specific legal and policy issues in a manner that accounts for climate change and creates flexible and resilient permits, management plans, laws, and policies governing resources.

ELI's companion publication, *Strategic Options for Adapting Laws and Policies*, provides an overview for policymakers of the importance of using adaptive management to protect biodiversity in the face of a changing climate. This resource manual provides specific, detailed guidance for those drafting the laws, regulations, and policies needed to implement adaptive management. The resource manual may also be helpful for on-the-ground resource managers to find new ways to work with existing legal authorities and policies.

The resource manual is organized into three parts, which are divided into thirteen chapters:

- **Part 1** presents an overview of the key elements of adaptive, ecosystem-based management that forms the model discussed throughout the resource manual.
- **Part 2** sets out a wide variety of legal, regulatory, and planning tools that will allow managers to adapt to climate change.
- **Part 3** applies these functions in four distinct resource management situations: permitting, licensing, and concessions for natural resource access and extraction; community based natural resource management; protected areas on public lands and waters; and private lands conservation.

Options to incentivize and support participation and compliance in these approaches are presented throughout the resource manual, along with examples, case studies, and other suggested resources.

Acknowledgments

This material was prepared by the Environmental Law Institute (ELI), with funding from the John D. and Catherine T. MacArthur Foundation. Project development, administration, and primary authors are Daniel Schramm, ELI Staff Attorney, Scott Schang, Vice-President, Climate and Sustainability, Carl Bruch, Co-Director of ELI's International Program, and Senior Attorney Lisa Goldman. The project has benefited immensely from the guidance, advice, review, and feedback of the Advisory Committee:

- **Manuel Pulgar-Vidal**, Sociedad Peruana de Derecho Ambiental (SPDA) (Peru)
- **Nelson Pimentel**, Instituto de Abogados para la Proteccion del Medio Ambiente (INSAPROMA) (Dominican Republic)
- **Kenneth Kakuru**, Greenwatch (Uganda)
- **Lalaina Rakotoson Randriatsitohaina**, Development and Environmental Law Center (DELC) (Madagascar)
- **Kunzang Kunzang**, National Environment Commission (Bhutan)
- **Hahn Vu**, Hanoi University of Law (Vietnam)
- **Tran Trang**, Law and Policy of Sustainable Development (LPSD) (Vietnam)

We gratefully acknowledge the advice, resources, and feedback provided by Dr. Lara Hansen (EcoAdapt Consulting), and Wm. Carroll Muffett.

The following external reviewers provided invaluable critique and suggestions: Liz Baldwin (IUCN Environmental Law Centre); Amanda Cleghorn (WWF); Alejandro E. Camacho (University of California, Irvine School of Law); Jonathan Cook (WWF); John Costenbader (IUCN Environmental Law Centre); Dr. Jamie Donatuto (Swinomish Indian Tribal Community); John M. Fitzgerald (Society for Conservation Biology); Victor B. Flatt (Center for Law, Environment, Adaptation and Resources (CLEAR), University of North Carolina Chapel Hill School of Law); Dr. Aline Kühl (UNEP/CMS Secretariat), Dr. Craig Loehle (National Council for Air and Stream Improvement (NCASI)); Andrew Long (Florida Coastal School of Law); Dr. Alan A. Lucier (NCASI); Karma C. Nyedrup (Bhutan National Environment Commission); Judy Oglethorpe (WWF); Catherine O'Neill (Seattle University School of Law); Bruce Pardy (Queens University); Johannes Stahl (Secretariat of the Convention on Biological Diversity); and Dr. Ben Wigley (NCASI). We also reviewed helpful input from participants at a May 2010 side event at the Subsidiary Body on Scientific, Technical and Technological Advice of the Convention on Biological Diversity.

Special thanks to ELI staff and interns for helpful internal review, and administrative and research support: Director of International Water Program Jessica Troell; Staff Attorney Read Porter; Science and Policy Analyst Rebecca Kihslinger; Research Associates Daniel Jesse Oppenheimer, Annie Brock, and Akiva Fishman; Law Fellow Catherine McLinn; Graphics Intern Guido Iglesias; Research and Publications Interns Nicholas Buttino, Ben Carrier, Selina Carter Emily Goldberg, Emily Jacklyn Hildreth, Paulo Lopes, Emily Norford, Kelly Rosencrans, Emily Seidman, Ricardo Smalling, Sarah Stellberg, Gabriella

Stockmayer, Jessica Renny, Ben Tannen, and Karla Torres; and pro bono legal researchers Jessica Villaverde and Guilherme Junqueira de Leal.

Table of Contents

Part 1: The Need to Adapt Biodiversity Management to Climate Change

Earth's biodiversity may be threatened by the worst extinction crisis in 65 million years.[2] Mounting evidence shows that climate change is accelerating the extinction rate and could have enormous negative consequences on natural resources that sustain livelihoods and economies.[3] The level of climate change expected by 2050 may be enough to drive thirty percent of all species to extinction.[4] More than twenty percent of animal and plant species are likely to be exposed to a greater risk of extinction under a 2-3 ^{o}C increase in temperature.[5] Population declines are not limited to rare species. Climate change is affecting organisms long considered "immune" to extinction risk, such as timber species and oceanic fish stocks.[6] While some species and ecosystems may tolerate or even thrive with moderate levels of climate change,[7] previous predictions have consistently underestimated the impact of climate change on the environment and the global economy (see Figure 1). The security of human livelihoods, communities, and economic development gains are all at grave risk.[8] The more we learn, the clearer it becomes that actions to adapt or adjust to changing climatic conditions are urgently needed.

---

[2] IUCN, Extinction Crisis Continues Apace (Nov. 3, 2009), http://www.iucn.org/?4143/Extinction-crisis-continues-apace.

[3] Wendy B. Foden et al., *Species Susceptibility to Climate Change Impacts*, *in* WILDLIFE IN A CHANGING WORLD: AN ANALYSIS OF THE 2008 IUCN RED LIST OF THREATENED SPECIES 77 (IUCN 2008).

[4] Chris D. Thomas et al., *Feeling the Heat: Climate Change and Biodiversity Loss*, 427 NATURE 145 (2004).

[5] *See* Fischlin, A., Midgley, G.F., Price, J.T., Leemans, R., Gopal, B., Turley, C., Rounsevell, M.D.A., Dube, O.P., Tarazona, J., Velichko, A.A., "Ecosystems, their properties, goods, and services," in: *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (ed. Parry, M.L., Canziani, O.F., Palutikof, J.P., van der Linden, P.J., Hanson, C. E.) 211-272 (2007).

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

[7] Alan Lucier et al., *Forest Responses and Vulnerabilities to Recent Climate Change*, *in* ADAPTATION OF FORESTS AND PEOPLE TO CLIMATE CHANGE: A GLOBAL ASSESSMENT REPORT 29, 30 (IUFRO 2009).

[8] *See* Edward H. Allison et al., *Vulnerability of National Economies to the Impact of Climate Change on Fisheries*, 10 FISH & FISHERIES 173 (2009); Jacob Silverman et al., *Coral Reefs may Start Dissolving when Atmospheric CO2 Doubles*, 36 GEOPHYSICAL RESEARCH LETTERS L05606 (2009). 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, 434 (2008); U.B. Confalonieri et al., *Human Health*, *in* CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY. CONTRIBUTION OF WORKING GROUP II TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 391 (M.L. Parry et al. eds., 2007); IUCN, ECOSYSTEMS, LIVELIHOODS AND DISASTERS: AN INTEGRATED APPROACH TO DISASTER RISK MANAGEMENT 13 (Karen Sudemeier-Rieux et al. eds. 2006).

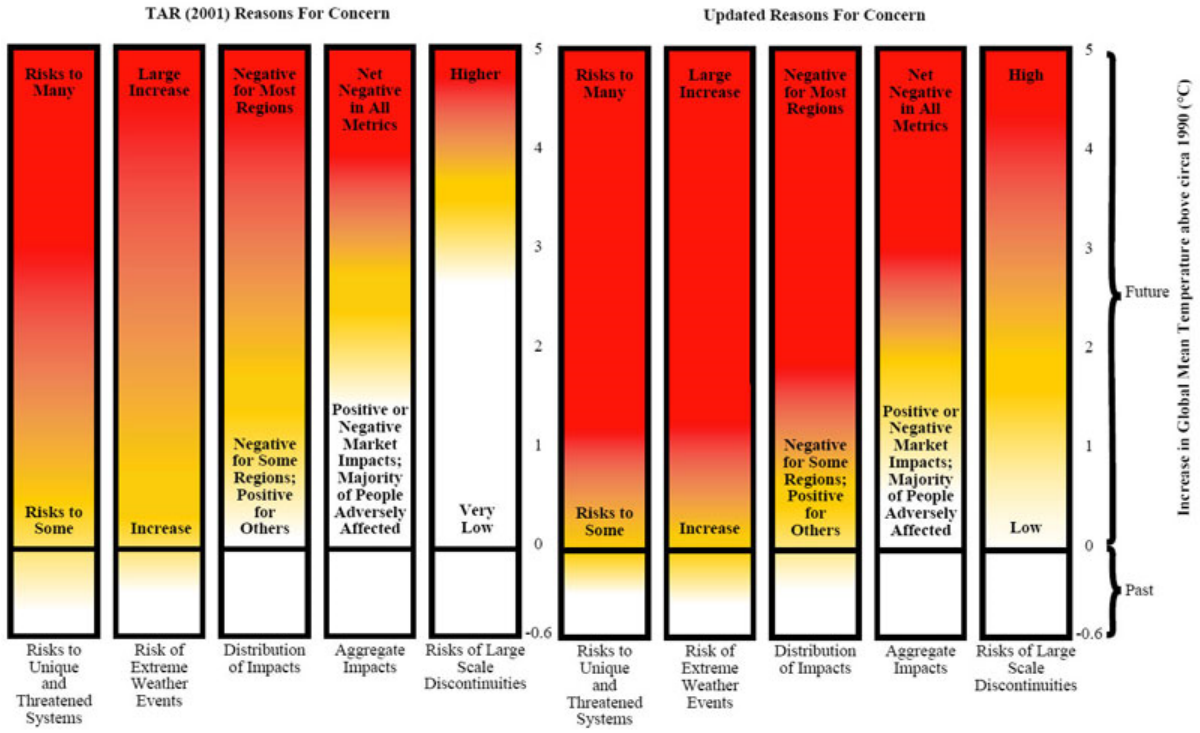


Figure X. "Burning Embers." In its 2001 "Third Assessment Report" (TAR), the Intergovernmental Panel on Climate Change (IPCC) used the graphic on the left to demonstrate how increasing temperatures increase the levels of risk in five specific reasons for concern. In 2009, researchers updated this graphic with the latest research (graphic on the right). They found the level of risk associated with each of the "reasons for concern" much higher than previously thought. An increase of just 1.0 degree C above 1990 levels (to which the planet may already be committed) poses a high risk to "unique and threatened systems."[9] **End caption**

Photo: Ecolibrary.org. **Caption:** Climate change is driving the resplendent quetzal higher up mountain sides in Costa Rica, but it will soon run out of higher-elevation habitat. One researcher calls this the "elevator to extinction." Seventy-nine percent of land-based bird

[9] 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).

species predicted to go extinct due to climate change are not legally categorized currently as threatened.[10] Another paper suggests that under only a 1 °C temperature rise the suitable habitat of high-elevation bird species is likely to be reduced by half.[11]

Table X illustrates the broad categories of impacts on biodiversity anticipated from climate change.

Table X. Projected Impacts of Climate Change on Biodiversity[12]

Climate change impact	***Impacts***	***Impact on biodiversity in vulnerable regions, subregions and ecosystems***
Increased air temperatures	Increased number of hot days	• Increased heat stress on biodiversity • Increased exposure to pests and diseases • Increased drying of wetlands and waterways
	Melting permafrost	• Changes in nutrient cycling and soil biodiversity • Reduced access to food sources as a result of repeated freeze-thaw cycles • Loss of cryosoil-based ecosystems and species • Drainage of lowland Arctic tundra • Sea level rise and as a result, in particular on islands, salt water intrusion in coastal wetlands and other inland waters, increased mortality and disturbance of critical habitats, and increased erosion (beaches / coastal cliffs)
	Decreased ice cover in polar regions, oceans, and high elevations (later freeze and earlier breakup)	• Reduced winterkills of both species of concern and pests • Decreased spring flooding leading to reduced deposition of sediments in floodplains • Sea level rise and as a result salt water intrusion in coastal wetlands and other inland waters, increased mortality and disturbance of critical habitats, and increased erosion (beaches / coastal cliffs)
	Increased water temperature	• Decreased dissolved oxygen • Increased vulnerability to invasive alien species • Coral bleaching and/or coral mortality • Increase of disease among fish • Loss of habitat for cold- and cool-water fish • Reduced productivity of marine systems (coral reefs and seagrass beds)

[10] Adapted from Cagan H Sekercioglu et al., *Climate Change Elevational Range Shift and Bird Extinctions*, 22 CONSERVATION BIO. 140 (2008); *Climate Change will Significantly Increase Impending Bird Extinctions, Study Says*, STANFORD REPORT (Dec. 6, 2007); Nicolas Ruggia, *Climate Change a Threat to Costa Rican Fauna, Another Study Finds*, TICO TIMES (Jul. 17, 2008).
[11] N. L. Rodenhouse, S. N. Matthews, K. P. McFarland, J. D. Lambert, L. R. Iverson, A. Prasad, T. S. Sillett and R. T. Holmes, "Potential effects of climate change on birds of the Northeast, Mitigation and Adaptation Strategies for Global Change," Volume 13, Numbers 5-6, 517-540, DOI: 10.1007/s11027-007-9126-1 (2008).
[12] Adapted from CONVENTION ON BIOLOGICAL DIVERSITY, BIODIVERSITY AND CLIMATE CHANGE, UNEP/CBD/SBSTTA/12/7, annex 1 (Mar. 27, 2007).

Climate change impact	***Impacts***	***Impact on biodiversity in vulnerable regions, subregions and ecosystems***
	Glacial retreat and decreased snow cover	• Changing hydrological regimes • Changes in seasonal cues for mountain biodiversity • Increased predation • Disruptions in hibernation patterns • Reduced insulating protection from snow • Loss of snow bed ecosystems and species
Changes in precipitation regimes	Increased instances of drought during the dry season in some areas	• Loss of ground cover leading to desertification and loss of soil biodiversity • Increased water stress on biodiversity • Reduced availability of food and fodder • Salinization in irrigated areas • Increased risk of fire • Changes in natural flow regimes of rivers and streams • Changes of alpine grassland to steppe
	Increased flooding during the wet season in other areas	• Increased erosion of soil • Increased land degradation • Increased threats from water-borne disease • Increased habitat destruction from flooding • Changes in natural flow regimes of rivers and streams
Increased frequency of extreme climatic events	Disruption in growth and reproduction	• Decreased overall productivity • Increased mortality
	Heightened storm surges	• Increased mortality and disturbance of critical habitat • Habitat loss (especially mangroves, reefs, sandbars and beaches)
Sea level rise	Salt water intrusion in coastal wetlands	• Increased mortality and disturbance of critical habitat • Salt water intrusion (coastal wetlands) • Increased erosion (beaches / coastal cliffs)

Policymakers and Managers Face High Uncertainty

Despite wide recognition that action is necessary, it is often not clear what should be done to adapt biodiversity protection to climate change. Which adaptations should be prioritized? Which measures will be effective not just in the short-term but the long-term? Policymakers and resource managers face high uncertainty in climate change impacts, especially when in the short-term these impacts are more the result of increased climate variability rather than a clear trend in one direction or another. Models are not always able to predict the frequency, severity, and location of extreme weather events, much less secondary and synergistic 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.[13]

[13] *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, at 136-39 (Adam Fenech et al. eds. 2009).

Side Box. A Note on Terminology. This manual uses the term "climate change" to refer both to the increased variability of climate conditions in the short-term and uni-directional shifts in climate conditions over the long-term. **End box.**

A 2009 survey by the U.S. Government Accountability Office of nearly two hundred natural resource managers in the United Kingdom and at the U.S. state and federal level found that their climate adaptation efforts were weak to non-existent because of the following factors:

- **Low Priority:** Limited resources are dedicated to more immediate needs while long-term threats like climate change go unaddressed.
- **No Data:** Insufficient site specific data make it hard to predict the localized impacts of climate change and more difficult for officials to justify current expenses for adaptation efforts for potentially less certain future benefits.
- **Weak Frameworks:** Adaptation efforts are constrained by a lack of clear roles and responsibilities among different levels of government officials.[14]

While these responses may not hold true in all countries, they point to the need for a new approach to resource law that drives and directs adaptive, proactive resource conservation and management.

Building Legal and Policy Tools for Responding to Climate Change

Constitutions, statutes, regulations, management plans, permitting rules, guidance documents, and other legal instruments have an extremely important role in responding to climate change impacts. There is a vast and growing set of policies, initiatives and projects to adapt to climate change around the world. The role of environmental law in this effort is to ensure these efforts do not become a "train without tracks"[15]—a series of well intentioned efforts without a guiding structure for long-term implementation. The law supplies political legitimacy, predictability, mechanisms to enforce obligations, and a framework for long-term, dedicated action.

The law also provides a forum to mediate disputes over resources. This is especially important for climate adaptation because as impacts of climate change intensify, there will be increasing conflicts over scarce resources. Rural communities faced with failing agricultural systems due to extreme drought or flooding may turn to the exploitation of surrounding resources for alternative livelihoods. At the same time, many wild species will likely need more protection, not less, to help them adapt to the effects of climate change. The success of biodiversity conservation increasingly depends on measures to adapt to climate change in many sectors, including water management, forestry, fisheries,

[14] U.S. GAO, CLIMATE CHANGE ADAPTATION: STRATEGIC FEDERAL PLANNING COULD HELP OFFICIALS MAKE MORE INFORMED DECISIONS, GAO-10-175T, at 4 (October 2009), *available at* http://www.gao.gov/products/GAO-10-113.).

[15] *See* Annecoos Wiersema, *A Train without Tracks: Rethinking the Place of Law and Goals in Environmental and Natural Resources Law*, 38 ENVTL. L. 1239 (2008).

mining, and agriculture. An integrated management approach is essential, as is a legal framework for carrying it out.

Box. Actions people take in response to climate change that fail to provide necessary long-term adaptation benefits, or which cause additional problems to the ones they were meant to solve, are called **maladaptive**. For example, a coastal city might build a levy to keep out rising ocean tides but this has the effect of increasing flooding and fragments coastal habitat. This measure could be said to be maladaptive. **End box**

Box. International Conservation Treaties and the Call for National Legislation
In undertaking legal reforms at the national and subnational levels, policymakers can draw on a range of international programs and authorities established by decisions of the Conferences of the Parties under several major conservation treaties (see Table 2). Above all, the call for policy and legal action to adapt biodiversity governance to climate change, in spite of uncertainty, is grounded in the **Precautionary Principle, as stated in Principle 15 of the Rio Declaration**: "*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*."[16] **End Box.**

The resource manual provides a set of options for assessing, using, and improving regulatory tools (or creating new ones) for adaptive ecosystem management in the face of climate change. The key elements of strongly adaptive legal frameworks are:

- Achievable objectives and measurable benchmarks that drive conservation policies forward and provide a standard to evaluate laws' effectiveness

- On-going, continuous decision making processes (rather than one-time-only assessments) to provide support for reassessing and adjusting policies, plans, and standards as conditions change and new information is gathered

- Monitoring requirements, incentives, and procedures for data collection and analysis that track changes in the biological, chemical, and physical characteristics of ecosystems over long time periods

- Information collection, management, and sharing with the public, stakeholders, and other agencies and governments to inform future decision making

- Coordinated and integrated policies and regulatory programs for coherent governance at the ecosystem level

- Effective balance between flexibility in on-the-ground decision making and enforceable standards and oversight to ensure improving outcomes over time

[16] Rio Declaration on Environment and Development, Principle 15, June 13, 1992, 31 I.L.M. 874, 879.

Box. Financing Adaptive Legal Frameworks and Management Strategies

Many of the concepts presented in the resource manual require dedicated financial support to carry out—something many developing countries will find difficult to provide. Greater commitments of financial and human resources are critical to defending biodiversity in the face of climate change. This is an investment with long-term benefits. The relevant cost comparison is between (a) management that fails to consider climate change (the status quo), leading to biodiversity die-off and economic losses; and (2) management that considers climate change (the adaptive approach), which allocates resources where they will be most effective and ensures ecosystems continue to provide goods and services. Failing to act is itself an action and will lead to negative consequences.

Although assessing financing options for adaptation is outside the scope of this resource manual, there is a growing network of funding and financial mechanisms that developing countries can access. This is a non-exhaustive list of international funding sources:[17]

- Global Environment Facility (GEF)
  - Strategic Priority on Adaptation Fund
  - Least Developed Countries Fund
  - Special Climate Change Fund
- United Nations Framework Convention on Climate Change
  - Adaptation Fund (overseen by Adaptation Fund Board)
  - Commitments by developing countries made at Copenhagen in December 2009; overseen by Advisory Group on Climate Change Financing
- World Bank
  - Climate Investment Fund (with Regional Development Banks)
  - Pilot Program for Climate Resilience
  - Global Facility for Disaster Reduction and Recovery (with the U.N. International Strategy for Disaster Reduction and donor governments)
- Asian Development Bank
  - Small Grants for Adaptation Actions
  - Climate Change Fund
  - Water Financing Partnership Facility
  - Poverty and Environment Fund
- African Development Bank
  - Climate Risk Management and Adaptation Strategy
- Inter-American Development Bank
  - Sustainable Energy Climate Change Initiative
- Bilateral Opportunities
  - U.S. Aid for International Development (USAID)

[17] Jordan Diamond and Carl Bruch, *The International Architecture for Climate Change Adaptation Assistance*, *in* CLIMATE CHANGE ADAPTATION AND INTERNATIONAL DEVELOPMENT: MAKING DEVELOPMENT COOPERATION MORE EFFECTIVE (Fujikura & Kawanishi, eds. Forthcoming Japan International Cooperation Agency 2010).

- UK Department for International Development (DFID)
- Netherlands Climate Assistance Programme (NCAP)
- Japan International Cooperation Agency (JICA)
- European Union Global Climate Change Alliance

END BOX

Chapter 1 Adaptation and Adaptive Ecosystem Management

This chapter introduces core concepts in biodiversity and natural resources management that will shape climate adaptation law, policy, and regulation:

- Climate change adaptation
- Adaptive management
- Ecosystem-based management

1.1 Adaptation: The Need to Consider Climate Change

Key Point: "Adaptation" includes a broad range of activities, policies, and social responses to climate change. By assessing and improving the design and function of legal frameworks governing biodiversity, policymakers, managers, and other stakeholders can develop a *planned* and *anticipatory* adaptation strategy that *reduces vulnerability* to climate change and *responds to impacts* of climate change.

The term **"climate change adaptation"** refers to the effects and consequences of climate change and measures to respond to those impacts. (Climate change **mitigation**, by contrast, refers to measures to reduce greenhouse gas emissions as a cause of climate change.) There are many definitions of climate adaptation. The IPCC defines it as:

> Adjustment in natural or *human systems* in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory, autonomous and planned adaptation:
>
> **Anticipatory adaptation** – Adaptation that takes place before impacts of *climate change* are observed. Also referred to as proactive adaptation.
>
> **Autonomous adaptation** – Adaptation that does not constitute a conscious response to climatic stimuli but is triggered by ecological changes in natural systems and by market or welfare changes in human systems. Also referred to as spontaneous adaptation.
>
> **Planned adaptation** – Adaptation that is the result of a deliberate policy decision, based on an awareness that conditions have changed or are about to change and that action is required to return to, maintain, or achieve a desired state.[18]

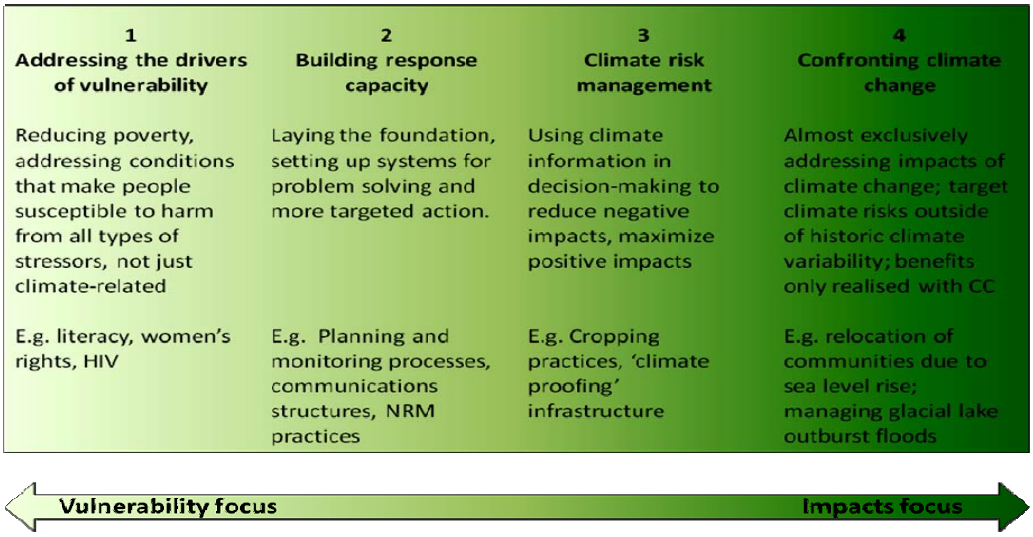
This resource manual presents legal and policy options to carry out the first (anticipatory) and third (planned) types of adaptation to protect the biodiversity of resources. In the context of biodiversity conservation, this narrower definition of adaptation may be useful:

> Climate change adaptation for natural systems is a management strategy that involves identifying, preparing for, and responding to expected

[18] IPCC Fourth Assessment Report, Working Group II Report, *Impacts, Adaptation and Vulnerability*, Glossary, 869 (2007).

> climate changes in order to promote ecological resilience, maintain ecological function, and provide the necessary elements to support biodiversity and sustainable ecosystem services.[19]

Adaptation takes place along a spectrum of policies and activities ranging from 'vulnerability-focused' to 'impacts-focused' (see figure X)[20] Vulnerability-focused activities help reduce general risks that may put people and the environment in greater danger from climate change effects. Impacts-focused activities are designed to respond to specific climate change effects.



Box. Vulnerability Assessments for Climate Change

Adaptation planning generally starts with a **vulnerability assessment**. The assessment helps to identify priorities for specific adaptation measures based on a determination of which groups, sectors, or communities are most at risk from the impacts of climate change. Vulnerability assessments can be done at the national level (such as the National Adaptation Programmes of Action (NAPAs) carried out by Least Developed Countries (LDCs)). Or they can be done at much smaller scales, such as for a specific economic development project. The U.S. Agency for International Development (USAID) uses a six-step approach to guide vulnerability and adaptation (V&A) planning at the project level:

1. Screen for vulnerability
2. Identify adaptation options
3. Conduct analysis

[19] KATIE THEOHARIDES ET AL., CLIMATE CHANGE ADAPTATION ACROSS THE LANDSCAPE: A SURVEY OF FEDERAL AND STATE AGENCIES, CONSERVATION ORGANIZATIONS AND ACADEMIC INSTITUTIONS IN THE UNITED STATES (discussion draft, February 10, 2009).

[20] Heather McGray, Anne Hammill, and Rob Bradley with E. Lisa Schipper and Jo-Ellen Parry, *Weathering the Storm: Options for Framing Adaptation and Development* (Washington, DC: World Resources Institute, 2007).

4. Select course of action
5. Implement adaptation
6. Evaluate the adaptation[21]

The adaptive management techniques presented here, particularly scenario planning (Chapter 4), information gathering tools (Chapter 5), and community outreach measures (Chapters 2 and 10), can all be used to support vulnerability assessments that will allow policymakers to identify priority areas for adaptation measures in their countries or regions.

1.2 Adaptive Management: Basic Models and Core Elements

Key Point: Adaptive management is a process for making decisions in an iterative manner based on lessons learned and changing circumstances. It provides a set of tools for both policymakers and managers to confront uncertainties caused by climate change. Those tools include:

- A guide for taking effective action in the face of uncertainty
- A method of increasing understanding through collection, sharing, and use of information
- A framework for achieving improved management outcomes with flexibility in how to achieve them[22]

Adaptive management uses on-going, periodic phases of implementation, monitoring, and adjustment to improve understanding and management of natural systems under conditions of uncertainty. This is distinct from many traditional methods of resource decision making in which little investigation, learning, or adjustment is done after an initial choice has been made. In contrast, adaptive management calls for "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."[23] Adaptive management is most often expressed in the simple phrase, "learning-by-doing."

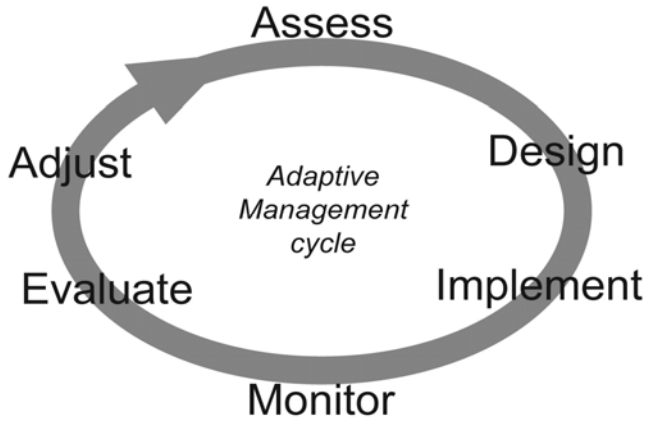
"**Adaptation**" to climate change and "**adaptive management**" are not the same thing. There are aspects of climate adaptation other than adaptive management, and adaptive management has been used for many years outside the context of climate adaptation. However, adaptive management is a very important model for implementing climate change adaptation measures because efforts to adapt are constrained by the problem of uncertainty and complexity of ecosystem responses, and adaptive management provides a framework for navigating and addressing that uncertainty.

---

[21] USAID, ADAPTING TO CLIMATE VARIABILITY AND CHANGE: A GUIDANCE MANUAL FOR DEVELOPMENT PLANNING (2007).
[22] *See* Joseph Arvai et al., *Adaptive Management of the Global Climate Problem: Bridging the Gap between Climate Research and Climate Policy*, 78 CLIMATE CHANGE 217 (2006).
[23] Carol Murray and David Marmorek, *Adaptive Management and Ecological Restoration, in* ECOLOGICAL RESTORATION OF SOUTHWESTERN PONDEROSA PINE FORESTS 417-18 (Ed. Peter Friederici, 2003).

Sidebar. A Six-step Process for Adaptive Management [24]

1. **Assess** existing situation, information, stakeholders, and collective objectives
2. **Design** and adopt measures (e.g., law, policy, permit, or programme), which are necessarily provisional
3. **Implement** management as an experiment to test theories and learn best practices
4. **Monitor** key trends, compliance, and effectiveness of measures
5. **Evaluate** effectiveness through periodic reviews using the new information
6. **Adjust** strategies and continue the cycle; reassess overall situation periodically.



END SIDEBAR

Climate change adaptation requires adaptive management, and adaptive management requires a framework of law to guide its implementation. However, existing laws governing biodiversity have often proved to be a poor fit for adaptive management because they do not provide clear guidance, rules of procedure, and other safeguards to ensure it is done properly. In the United States, where adaptive management has been used for many years, this has at times resulted in lack of agency follow-through, management failures, and misuse of the process.[25] Adaptive management in the absence of clear rules of procedure has been criticized for increasing discretion at the expense of accountability.[26]

[24] Cycle graphic adapted from *id.*
[25] J.B. Ruhl, *Regulation by Adaptive Management—Is it Possible?*, 7 MINN. J. L. SCI. & POL'Y 21 (2005).
[26] Bradley C. Karkkainen, *Adaptive Ecosystem Management and Regulatory Penalty Defaults: Toward A Bounded Pragmatism*, 87 MINN. L. REV. 943 (2003).

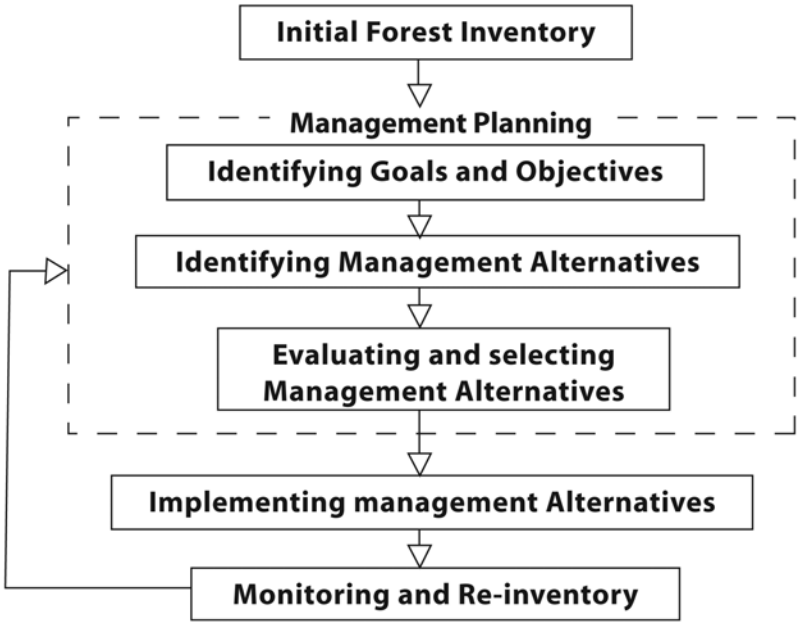


Figure X Caption. This diagram demonstrates adaptive management as applied in a forest resources management context. This could be adjusted to apply to other types of natural resource management. The requirement to complete an "initial inventory" is explicit here. Establishing an historical baseline against which to measure future trends is essential for effective management of resources in fluctuation due to climate change. **End Figure**

Based on past attempts to implement adaptive management, there are several things that we can safely say it is **not**:

- Adaptive management is not an excuse to forego gathering all available information before developing a management plan. The phrase "learning-by-doing" is not intended to be an excuse to avoid rigorous analysis of information at hand prior to the "doing."
- Adaptive management does not favor more intensive use of natural resources over non-consumptive conservation options. Adaptive management is not a deregulatory structure, and it calls for a *more* rigorous program of implementation and testing to identify the most ecologically sound strategies for managing and conserving natural resources.
- Adaptive management is not a purely scientific exercise in which stakeholders, democratic processes, and value choices have no role. Rather, adaptive management uses a rigorous scientific process to develop, test, and improve management strategies. But these strategies will be used to accomplish goals and objectives that are defined in large part by economic needs and social values.

1.3 Ecosystem-based Management

Key Point: Effective biodiversity management in the face of climate change requires close attention to trends in the physical, chemical, and biological elements of ecosystems

as a whole. Therefore, ecosystem-based management provides a model for holistic biodiversity governance rather than focusing exclusively on a particular species, resource, threat type, or sector.

Ecosystem-based management (also called the "ecosystem approach") is closely related to adaptive management. The two models are increasingly linked as part of the same basic management approach. Ecosystem management emphasizes the importance of taking into account the complexity of interactions between the biological, chemical, and physical elements of a defined area. Changes in these patterns caused by climate change might include: warming and chemical changes in water bodies, the arrival of new species, the loss of endemic species, and changes in nutrient cycles and water cycles. Whereas older models of resource management tended to focus only on a single target resource (such as an economically valuable timber species), ecosystem management calls on managers and stakeholders to take into account the relationships between the target resource and other ecological features and services, such as predator-prey relationships, nutrient and hydrological cycles, and the influence of human activities on the system.[27]

Like adaptive management, ecosystem-based management is a very important tool for biodiversity adaptation to climate change. The Convention on Biological Diversity urges member governments to take an ecosystem-based approach to adaptation, in order to ensure

> a flexible management framework to address climate change mitigation and adaptation activities in a broad perspective. This holistic framework considers multiple temporal and spatial scales and can help to balance ecological, economic, and social considerations in projects, programmes, and policies related to climate change mitigation and adaptation. "Adaptive management," which allows for the reevaluation of results through time and alterations in management strategies and regulations to achieve goals, is an integral part of the ecosystem approach.[28]

Chapter 7 covers in detail legal and policy tools for coordinating and integrating different agencies, institutions, businesses, and other societal actors in order to ensure that adaptation to climate change systematically incorporates the larger ecosystem.

Sidebar. The 12 Principles of the Ecosystem Approach of the Convention on Biological Diversity

1. The objectives of management of land, water and living resources are a matter of societal choice.
2. Management should be decentralized to the lowest appropriate level.

[27] *See* ENVTL. L. INST., OCEAN AND COASTAL ECOSYSTEM-BASED MANAGEMENT: IMPLEMENTATION HANDBOOK (2009), *available at* http://www.eli.org/Program_Areas/ocean_ebm.cfm.
[28] INTERLINKAGES BETWEEN BIOLOGICAL DIVERSITY AND CLIMATE CHANGE: ADVICE ON THE INTEGRATION OF BIODIVERSITY CONSIDERATIONS INTO THE IMPLEMENTATION OF THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE AND ITS KYOTO PROTOCOL, CBD TECHNICAL SERIES NO. 10, at 4 (2003), *available at* http://www.cbd.int/doc/publications/cbd-ts-10.pdf.

3. Ecosystem managers should consider the effects (actual and potential) of their activities on adjacent and other ecosystems.
4. Recognizing potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem-based management programs should:
    a. Reduce those market distortions that adversely affect biological diversity (i.e., eliminate perverse subsidies, etc.);
    b. Align incentives to promote biodiversity conservation and sustainable use;
    c. Internalize costs and benefits in the given ecosystem to the extent feasible (including full accounting for ecosystem goods and services).
5. Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach.
6. Ecosystems must be managed within the limits of their functioning.
7. The ecosystem approach should be undertaken at the appropriate spatial and temporal scales.
8. Recognizing the varying temporal scales and lag effects that characterize ecosystem processes, objectives for ecosystem-based management should be set for the long term.
9. Management must recognize that change is inevitable.
10. The ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity.
11. The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices.
12. The ecosystem approach should involve all relevant sectors of society and scientific disciplines. **End Sidebar**

[INSERT BANYAN TREE DIAGRAM HERE WITH CAPTION]

Caption: **Putting it all together.** A fully adaptive, ecosystem-level structure for biodiversity management might look something like this. The banyan tree grows throughout South Asia. It has aerial roots that grow down from the branches back into the soil. This symbolizes the cyclical nature of adaptive resource governance. In this model, information and lessons learned from localized management (the 'branches') is systematically used to improve decision making at larger scales and in other regions. This system relies on many of the existing principles and values in environmental law, but adds a set of more robust information-forcing mechanisms to improve learning and increase the resilience of the system to climate change. The resource manual covers each of these elements in greater detail.

Chapter 2 Using "Active" Adaptive Management

> Adaptive management experiments can be categorized into two types: "passive" and "active." In passive adaptive management, alternatives are assessed, and the management action deemed best is designed and implemented. Monitoring and evaluation then lead to appropriate adjustments. In active adaptive management, managers explicitly recognize that they don't know which activities are best, and then select several alternative activities to design and implement. Monitoring and evaluation of each alternative help in deciding which was more effective in meeting objectives, and adjustments to the next round of management decisions can be made based on those lessons.[29]

Active adaptive management, even more than "passive" adaptive management, calls on managers to question initial assumptions and intentionally test management hypotheses by "navigating through trial and error and conscious experimentation." Though more difficult to implement, it may be more effective for ecological learning and management in the face of climate change.[30] Use of active adaptive management techniques on several plots or zones may be an appropriate response to climate change, but will likely need legal authorization and guidance before managers can use it responsibly and effectively.

Box. There are a variety of methods of actively learning while engaged in management activities, including computer modeling, laboratory work, extrapolation from other systems, and compiling and analyzing historical data.[31] For resource agencies in developing countries, however, these methods may actually be more difficult than designing "do-it-yourself" experiments that rely less on technological instruments and more on a strong commitment of human resources and good organization. **End box**

2.1 Using Test Plots or Zones as a Tool for Learning

Key Point: Active adaptive management uses testable hypotheses and "experimental" management plans to improve learning about ecosystems. The more active experimental approach allows managers to more quickly determine how climate change is impacting managed resources and which techniques best respond to the impact.

The key element of active adaptive management is the concurrent implementation of several different management strategies to see which performs best over a given time period. An important consideration in setting up a project like this is that the zones or areas selected for different strategies should be as similar as possible in all characteristics except the element to be tested. This needs to be done in order to isolate the factors in

---

[29] Murray & Marmorek, *supra* note X, at 420-21.
[30] *See* BD. ON SUSTAINABLE DEV., NAT'L RESEARCH COUNCIL, OUR COMMON JOURNEY: A TRANSITION TOWARD SUSTAINABILITY 6-7, 10 (1999).
[31] Holly Doremus, *Precaution, Science, and Learning While Doing in Natural Resource Management*, 82 Wash. L. Rev. 547, 570 (2007).

management that are driving the different outcomes. For example, let's say managers are working to protect a coral reef system that is highly stressed due to climate change and a host of other human factors. They believe one way to protect the coral reef is to reduce the harvest of a species of fish that consumes an algae that prefers warmer water and harms the coral. By reducing harvest of the fish species, the managers believe the algae population can be kept in check, giving the coral reef a better chance of surviving the warmer water temperatures. At the same time, managers believe that agricultural runoff from nearby lands is also negatively impacting the coral reef. But they are unsure whether the high levels of nutrient pollution or the algae are a greater threat to the coral.

Traditional laws governing resource management do not give managers much authority or guidance for organizing management experiments to test their theories. Active adaptive management, however, gives them a framework for trying several different approaches and learning which works best for the coral reef.

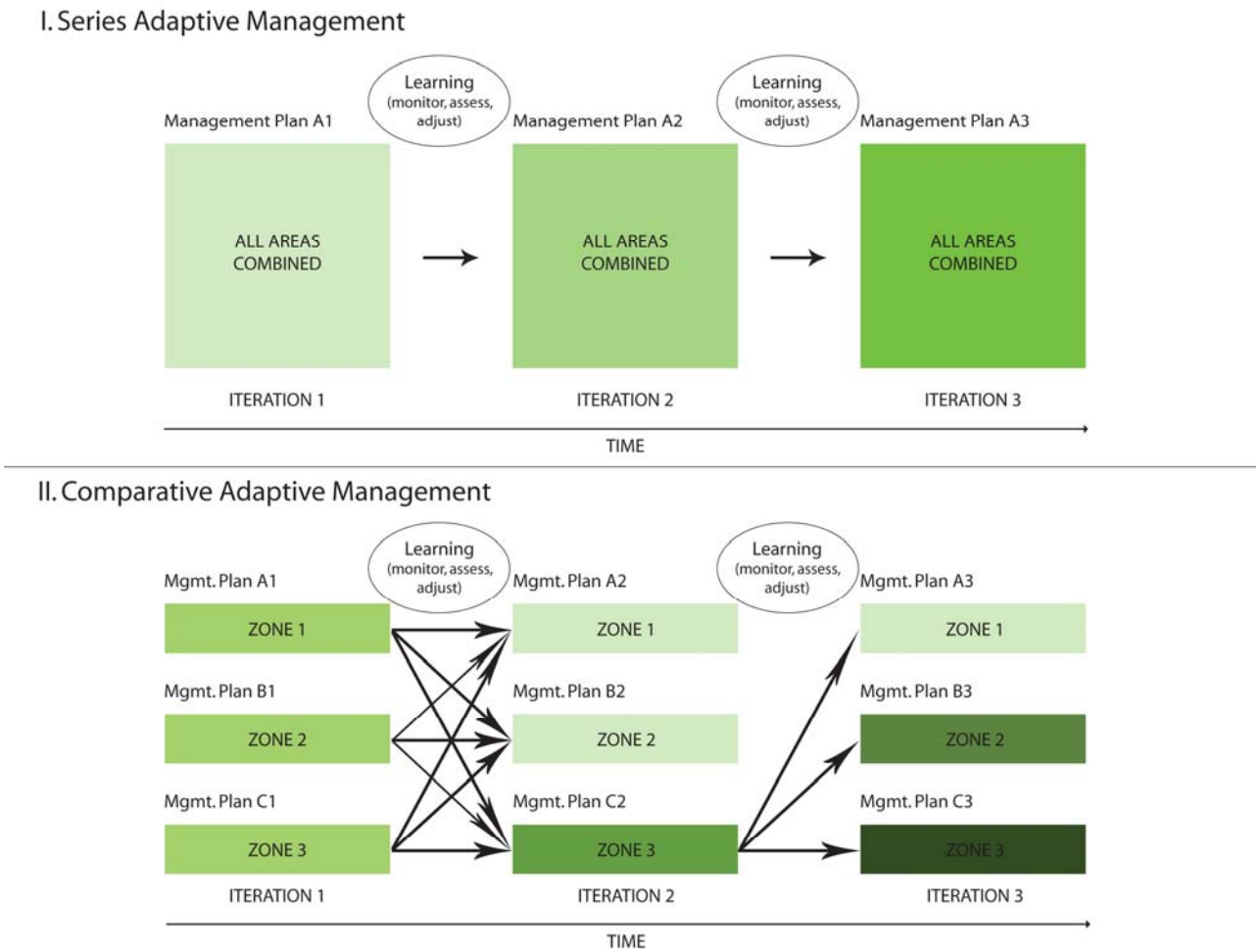


Figure X. These two graphs illustrate the differences between a single-strategy style of adaptive management and one that tests multiple strategies at the same time. Darker shading represents improved outcomes from management; arrows represent transfer of ideas about successful management. In Graph I, only one management strategy is implemented. The opportunities for learning are limited because at each stage, only one

set of variables can be tested. In Graph II, however, there are three separate management strategies. (These "zones" might be entire regions or countries in which different strategies were attempted; comparative learning would take place through institutional arrangements on an international or inter-jurisdictional scale.) Between Iterations 1 and 2, we see learning occurring among all the different zones as information is exchanged. In Iteration 2, the lighter colors signify that ecological conditions are worsening, and only Zone 3 sees an improvement in conditions. Thus it may be that information exchange does not immediately produce positive results for comparative management. In Iteration 3, however, information is again exchanged, with best ideas (signified by the arrows) coming from the successful management strategy identified in Zone 3. Both Zones 2 and 3 show strong improvement. Zone 1's management approach remains ineffective. This may be because of a flaw in the management, or it may be the result of anomalous regional factors that managers cannot control. Nonetheless, the lessons learned from experiences in Zone 1 may be useful to share among all managers.

Another consideration before implementing an active adaptive management program is that larger-scale projects (e.g., covering an entire forest unit rather than a single timber permit) will be in a better position to use a zone based, experimental approach. In the United States, the Northwest Forest Management Plan covering several states is the strongest example of the benefits of a regional scale approach to adaptive ecosystem management. These types of projects provide economy-of-scale benefits:

- Broader assessment of regional trends caused by the effects of climate change
- Greater use of trade-offs to build consensus between competing interests
- Greater manipulation of variables among different zones, including the establishment of "control" areas to be used as the standard against which results can be compared
- Greater flexibility to revise management guidelines to reflect lessons learned
- Greater engagement from high-level political actors
- National legislatures more willing to allocate specific funding for projects that allow an "integrated resource planning" approach intended to provide co-benefits across sectors
- Greater ability to command deference for experimental activities from reviewing courts due to the higher level of scientific and regulatory expertise[32]

2.2 Negotiating Trade-offs and Avoiding Inequitable Results

Key Point: Despite the potential benefits of active adaptive management in terms of accelerated learning and improved outcomes, special care must be taken to ensure vulnerable resources and communities are not exposed to greater harm from climate change as a result of a poorly designed experimental plan.

[32] Robert Fischman & J.B. Ruhl, *Adaptive Management in the Courts*, 94 MINN. L. REV., draft copy at 23-31 (forthcoming 2010).

Active adaptive management requires trust, cooperation and equity across stakeholder groups. Careful planning and monitoring of ecosystem status are necessary to ensure damage is not done to a resource. If harm does occur, it may exacerbate preexisting tensions between stakeholders and cause an escalation in resource conflict. The active method is most appropriate where all stakeholders are capable and prepared to commit themselves to an equitable distribution of its risks and benefits.

To avoid or reduce these problems and ensure equity among participating resource users, a strong foundation of legal rights and relationships is essential. The rights and duties of the various stakeholders should be recognized and, depending on the complexity of the management plan, clarified with respect to the proposed strategy. This can be done through an agreement or contract negotiated among stakeholders under the leadership of or mediated by government officials. Such an agreement will be shaped by many local, place-based considerations, but might include:

- Provisions for dispute resolution including court review or neutral arbitration
- Indemnification of a particular user group if that group suffers a substantial loss in value of their resource as a result of the experimental management strategy under which they are operating
- Benefits obtained from one management variant shared equitably by all stakeholder groups engaged in the program
- Special evaluation of the impacts on any identified marginalized groups such as women, low-income, or racial, ethnic or religious minorities
- Frequent reviews of implementation of variants to quickly identify and halt those management variants that are determined to be harmful to the resource
- Swift and severe penalties of any attempt to sabotage, alter, or falsify the scientific information gathered from implementation, or to in any way disrupt the process of learning and evaluation established in the management plan
- Multiple, redundant safeguards using a mixture of independent oversight and checks and balances to prevent capture of the process by any one interested party (See the first bullet)

2.3 Case Study: Active Adaptive Shark Fisheries Management in Mexico

Key Point: Mexico's shark management program is strongly adaptive and provides a model for adaptive frameworks for climate change because it:

- Sets achievable objectives at the whole ecosystem level
- Acknowledges uncertainties and establishes a framework for answering them
- Uses multiple strategies that can be evaluated simultaneously to learn the best management techniques more quickly
- Sets comprehensive monitoring requirements that respect different capacities

Sharks are a vital natural resource for the Mexican economy, providing a source of food, tourism revenues through sport fishing and diving excursions, and income for Mexico's shark fisherfolk. Although the numbers of shark vessels and permits for shark fishing have remained stable over the last decade, there has been a decrease in the volume of

coastal shark captures. Moreover, recent studies show that approximately half of the production of commercially important shark species in the Gulf of Mexico are immature or neonate organisms, indicating instability in the reproduction and maintenance of the shark populations.[33]

In response, the Mexican government has developed two evolving legal instruments: the National Plan of Action for the Management and Conservation of Sharks, Rays, and Related Species (the Plan) and the Official Mexican Regulatory Norm for the Responsible Fishing of Sharks and Rays (the Regulation). The Plan is explicitly designed to be an adaptive, transparent, permanent, yet flexible management plan that contains important scientific information, considers stakeholder needs, and includes policy recommendations.[34] The Regulation establishes strict and enforceable regulations governing the shark fisheries. The interworking of these two instruments provides an effective model for collaboration between stakeholders and regulators in which the Plan development process generates management strategies as new threats emerge and provides an institutional mechanism to move new information into the legal requirements of the Regulation.

The Mexican management scheme demonstrates high adaptive management capacity in other respects. The legally-binding Regulation establishes achievable **ecosystem-based management objectives**, for example: reducing capture of neonate and juvenile sharks, and reducing the detrimental effect of over-fishing of sharks not just on shark populations, but other deepwater fishes and the marine ecosystem. The Plan explicitly identifies **knowledge gaps** that impede the development of best management practices and makes them learning objectives to be met over the course of implementation. Among these objectives, the Plan lists the following: (a) identification and location of critical shark habitat areas; (b) the improvement and systematization of biological data collected from shark captures; and (c) the evaluation of threats to shark populations.[35]

The Plan specifies focus areas for research to improve future management, such as studies to determine what time periods and in which locations ships are catching pregnant females.[36] Incidental taking by fishing vessels not licensed to take sharks is not well quantified, so this is an area for study as well.[37] (Incidental takes also create a regulatory gap that could threaten the entire management program.) Similarly, the Regulation makes clear that there are many unknown regulatory factors related to biological and environmental conditions, fishing technology, and cultural and economic needs, that must

[33] Norma Oficial Mexicana NOM-029-PESC-2006, Pesca responsable de tiburones y rayas. Especificaciones para su aprovechamiento [Official Mexican Norm NOM-029-PESC-2006, Responsible Fishing of Sharks and Rays], Diario Oficial de la Federación [D.O.], 0.10, .011, 14 de febrero de 2007 (Mex.) [hereinafter NOM-029-PESC-2006].
[34] Comisión Nacional de Acuacultura y Pesca & Instituto Nacional de la Pesca, PLAN DE ACCIÓN NACIONAL PARA EL MANEJO Y CONSERVACIÓN DE TIBURONES, RAYAS Y ESPECIES AFINES EN MÉXICO [MEXICAN NATIONAL ACTION PLAN FOR THE MANAGEMENT AND CONSERVATION OF SHARKS, RAYS, AND RELATED SPECIES] 7 (2004) [hereinafter PANMCT].
[35] PANMCT, *supra* note 3, at 7.
[36] PANMCT, *supra* note 3, at 20.
[37] PANMCT, *supra* note 3, at 23.

be determined, evaluated, and implemented.[38] The Regulation directs the National Commission on Aquaculture and Fishing (CONAPESCA), Mexico's fisheries authority, to determine these factors in consultation with all stakeholders, including state and regional governments, non-governmental environmental organizations, and the fishing industry.[39] By defining at the outset the information needed in order to develop effective management, the Plan creates a motivating framework for data gathering and information assessment.

The Plan allows for an **active adaptive management** approach through use of multiple fishing zones. The Plan lists possible alternative management strategies without endorsing any one in particular and recommends that multiple strategies be allowed and employed through the Regulation. Through actual experience and evaluation, the various management plans will be allowed to adapt and develop in future versions of the Regulation. The Plan identifies five ocean zones with similar climatic, ecological, and economic conditions and calls for the application of different management strategies in different zones so that the most adequate matches for each zone can be determined.[40] Because a wide range of techniques are encouraged to be used simultaneously within a range of specified ocean zones, the Plan can accurately be described as an active adaptive management scheme. Such a system of zones and multiple management strategies allows CONAPESCA and regional fisheries offices the flexibility to employ the form of management best matched to their local resources, monitoring capability, and learning objectives. Thus, management and learning can occur simultaneously, and what is learned from earlier stages of management can then be employed to adjust future regulation.

The Plan and the Regulation employ **diverse monitoring and reporting techniques.** The Regulation goes beyond monitoring for compliance with regulations and requires data to be collected on multi-factor ecological indicators of the status of the fisheries and habitat. Monitoring programs provide for the systematic collection of data on shark species abundance, percentage of juvenile sharks per catch, size of sharks, and numbers of pregnant sharks caught. This data can then be used to inform future changes to the regulations and management programs authorized by CONAPESCA. (In many countries, this level of monitoring may not be feasible; options for supporting monitoring programs are discussed in Sections 5.3 and 10.5.)

Differences in stakeholder capacities are respected by monitoring and reporting regulations that apply differently to licensees depending on the size of the fishing vessel. The rules for shark vessels greater than ten meters in length are more stringent, and include participation in satellite mapping and reporting precisely on catches by volume and species.[41] This allows Mexico's agriculture and fisheries ministry, SAGARPA, to coordinate information about species and shark characteristics in each catch to specific

[38] NOM-029-PESC-2006 at 0.16.
[39] NOM-029-PESC-2006 at 0.16.
[40] PANMCT, *supra* note 3, at 41-42.
[41] NOM-029-PESC-2006 at 4.3.10.3-7.

oceanic zones so that information on migration areas, reproductive regions, and species abundance can be more readily evaluated.

Large ships must also participate in the On-Board Observers program that requires a ship's captain to admit, house, and feed a technical observer designated by SAGARPA; to provide the observer with adequate work space; and to take actions to facilitate the activities of the observer during fishing expeditions. Such actions may include helping to liberate sea turtles from fish hooks, supporting the observer in recording accurate information, especially related to fish captures, and providing communication and navigation instruments.[42] The On-Board Observers program provides a means to both ensure licensee compliance with Regulation provisions and to confirm the accuracy of licensee-reported statistics.

There remain gaps in Mexico's shark management system. Most critically, although the Plan and the Regulation call for evaluation of many ecological indicators, chemical and physical changes to the environment caused by climate change are not among them. The adaptive characteristics of the program may allow these impacts to be assessed but this analysis may be fragmented or incomplete without clearer guidance in the framework documents. Also, the management framework does not comprehensively address undocumented catches, by-catch, small vessel non-compliance, and other means by which individual or small-scale actions in the aggregate undermine management objectives.[43] In Mexico, fishing for personal consumption requires neither a license nor a permit.[44] Although the Regulation applies to vessels that incidentally take sharks pursuant to other activities,[45] very little information is available on the extent of impact of these vessels on the shark fisheries.[46] A lack of incentives to encourage shark fisherfolk to participate and comply with the management plan increases the likelihood that illegal fishing will continue.

[42] NOM-029-PESC-2006 at 4.3.10.7.
[43] Exequiel Ezcurra et al., *Gulf of California, Mexico, in* Ecosystem-Based Management for the Oceans 227, 242 (Karen McLeod & Heather Leslie eds. 2009).
[44] Reglamento de la Ley de la Pesca [Rules for the Law of Fisheries], *as amended*, Diario Oficial de la Federación [D.O.], Artículo 31º, 28 de Enero de 2004 (Mex.).
[45] NOM-029-PESC-2006 at 1.2.
[46] PANMCT at 23.

Chapter 3 Public Participation in Adaptation and Adaptive Management

This chapter discusses several different roles for the public and communities in adaptation measures for biodiversity. In many societies, the close proximity of communities to rich biodiversity areas makes it essential that they be included in management efforts generally. These programs and elements are an intrinsic and fundamental part of the adaptive ecosystem-based management model for adaptation presented in the two preceding chapters. Public participation programs enhance climate adaptation efforts by:

- Including all stakeholders, who may have different experiences, ideas, or lessons to share about climate change
- Helping to avoid independent or individual actions to adapt to climate change that are maladaptive or cause unnecessary harm to ecosystems or biodiversity
- Providing checks and balances to ensure efforts at adaptive management are implemented fairly and according to correct procedures
- Integrating different modes of knowledge (scientific, multi-disciplinary, traditional, local, and indigenous knowledge), each of which contributes different insights on adapting to climate change
- Creating a vested, growing, and informed base of local actors engaged in management issues related to climate change over the long term

3.1 Applying the Tools of Participation and Collaboration to Biodiversity Adaptation

Key Point: Existing public participation requirements, information disclosure rules, and programs for decentralized or community-based resources management can be used to strengthen adaptation to climate change.

The tools of public participation, collaboration, and citizen oversight used in environmental law have important roles to play in building more adaptive governance structures. By increasing the pool of participants in management and giving voice to a larger number of perspectives and considerations, management institutions can more quickly identify emerging concerns and develop response strategies.[47] Tools to increase participation in management include:

- Public comment periods on proposed government activities
- Public surveys of attitudes and experiences with climate change
- Personal interviews about attitudes and experiences with climate change
- Mapping projects for indigenous or local lands and resources to establish baselines of resource availability

[47] *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, 361 (2009); J. Sendzimir et al., *Assessing the Resilience of a River Management Regime: Informal Learning in a Shadow Network in the Tisza River Basin*, 13 ECOL. & SOC'Y 11 (2007).

- Broad right of stakeholders and the public to comment on government actions or private activities requiring an environmental impact assessment related to climate change, and enforceable requirements on agencies to consider those comments
- Legal right of non-governmental organizations (NGOs) and community groups to participate in regulatory or judicial proceedings related to climate change or adaptive management
- Information disclosure requirements, including limits on information that can be withheld as confidential by agencies (with protections for business)
- Publicly accessible and easy-to-use databases of information on regional climate impacts

Box 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."[48]
End box

There are varying degrees of public participation. (See Table X.) Mechanisms and methods of participatory resource governance, ranging from assessment of stakeholder attitudes about climate change to fully active, devolved community management are presented in Chapter 11.

Table X. Options for Level of Community Participation[49]

Level of Participation	**Description**
1. Fully active (Highest)	Community members make decisions in partnership with implementing agency or groups and are committed to acting together
2. Deciding together (Higher)	Community members are empowered and facilitated in order to determine options and make decisions
3. Consultation (Moderate)	Community members participate actively in discussions but lack decision making authority
4. Information collection (Lower)	Community members are surveyed and results are analyzed externally
5. Passively informing (Lowest)	Community members are informed of the situation or process

[48] CBD COP, Decision VIII/30 (2006).
[49] Adapted from HUGH GOVAN ET AL., LOCALLY-MANAGED MARINE AREAS: A GUIDE TO SUPPORTING COMMUNITY-BASED ADAPTIVE MANAGEMENT 7 (2008).

Caption Youth are sworn in to the Dominican Republic's National Service of Environmental Protection Volunteers, set up to assist officials and work with NGOs on environmental protection.[50]

3.2 Active Information Exchange with Stakeholders and the Public

Key Point: Actively providing information to stakeholders and the public is as important as gathering and storing data. Institutions, networks, technology, and other strategies that get information to the right people quickly improve responsive capacities for climate change and can also improve methods of responding to climate-related disasters such as hurricanes, flooding, or forest fires.

Building institutional capacity for information sharing can improve the relationship between governments, civil society, resource users, and other stakeholders. Information sharing also gives resource users the ability to make smart choices about when and how they harvest or extract resources in response to changing climate conditions. Both sides have something to gain by sharing information with one another.

The existence and scope of information-sharing laws should be explored and their mandates adapted to build institutions for robust, real-time information exchange on climate change. Allowing the public relatively wide access to environmental information ensures that it moves quickly to those who need it. (See Chapter 9.3 on legal rights to environmental information.) In organizing the data gathered through ecosystem monitoring programs, it will be useful to develop a user-friendly database that is easily accessible.[51] The use of a searchable online "clearinghouse" is an effective means to do this.[52]

The next step in information management is active information dissemination. Disclosure rules that allow government to withhold data until it is specially requested can significantly delay adaptation measures by the public. Climate change requires that

[50] The Green Team Blog, A Green Volunteer Corps for the DR (March 9, 2006), http://dr1.com/blogs/?category=environmental%20justice&u=environment (last visited July 16, 2010).
[51] Sergej Olenin, *Online Alien Species Database: Experience of Regional Cooperation in the Baltic Sea Area*, REPORT PREPARED FOR THE EXPERTS MEETING TOWARDS THE IMPLEMENTATION OF A GLOBAL INVASIVE SPECIES INFORMATION NETWORK (GISIN), 6-8 APRIL, 2004, *available at* http://www.gisinetwork.org/Documents/ProceedingsPDF/GISINProc2004_Olenin.pdf.
[52] For examples, see Baltic Marine Biologists Working Group on Non-indigenous Estuarine and Marine Organisms *available at* http://www.corpi.ku.lt/nemo/; Clean Air Initiative for Asian Cities, CitiesACT, *available at* http://www.citiesact.org/; SERVIR *available at* http://www.servir.net/en/; and DAISIE European Invasive Alien Species Gateway http://www.europe-aliens.org/.

resource agencies communicate in a much more active and timely manner with communities and resource users. Active information dissemination can be done through a number of venues.

- Radio/TV announcements
- Billboards and other large advertisements (e.g., on buses or trains)
- VHF shortwave radios
- Social networking websites
- Text messages
- Newspapers, churches, schools, community bulletin boards

The nature of the audience is an important consideration in undertaking climate adaptation outreach and information campaigns for the public. Climate data, especially when presented in dense, scientific terminology, may frighten, confuse, or alienate some communities. Explaining climate impacts and uncertainties in terms and by methods that are locally meaningful and context-specific will improve people's receptivity of the information.

Example: Research on fishing communities on the Rio de la Plata in South America found maladaptive, over-exploitative patterns of fishing due to uncertainties resulting from climate variability.[53] The fish moved depending on the location of suitable water temperatures, making them difficult to locate. When they were found, the fishermen tended to overharvest out of uncertainty that the fish could be located again. Researchers concluded the most immediate need for both the fish and the fishermen was *not* more stringent regulation: this would only weaken the strained level of trust between managers and resource users. The fishermen needed better information on where the fish would be found and how to avoid overharvesting. They proposed an "Adaptation Control Information System," to allow for collaborative adaptive management between stakeholders and agencies that would prioritize "integration of local and scientific knowledge, training, enhancement of data collection systems, weather and climate forecasting, and real-time communication to users (fishermen [and the] Coast Guard)."[54]

3.3 Community-led Adaptation Strategies

Key Point: Adaptation to climate change necessarily occurs at a local level to respond to localized impacts of climate change. Community engagement and ownership of the adaptation planning process is a crucial component of any larger adaptation policy framework.

Long-time residents of an area, including traditional or indigenous communities, often have extensive knowledge of their local ecology. This knowledge can supplement scientific knowledge, or may be sufficient on its own to guide a local community's

[53] Gustavo Nagy et al., *Adaptive Capacity for Responding to Climate Variability and Change in Estuarine Fisheries of the Rio de la Plata*, AIACC Working Paper No. 36, at 8 (August 2006).
[54] *Id.* at 13.

development of adaptation strategies. Traditional knowledge includes information related to climate change trends and impacts, such as:

- Interpretation of meteorological and climatic phenomena
- Management of relationships between society and ecosystems
- Adaptation to environmental and social change[55]

For many communities, drawing on their own traditions for adaptation mechanisms will promote the acceptance of such measures. For example, traditional breeds of livestock and agricultural produce that have been displaced by foreign breeds or hybrids may prove more adaptive to climate change than their replacements. Traditional methods of insurance that covered disaster or famine victims could be helpful. However, it is also important to recognize that there will be situations where climate change impacts are so significant that they are beyond the ability of the local community to cope, and outside assistance or support is necessary.

Box. Respecting Indigenous Peoples' Rights in Adaptation Decision-making
Indigenous people are "peoples" as that term is used in international law to denote groups with inherent rights, including rights to self-determination. Often they possess rights to and management authority over land and resources—powers recognized in Article 26 of the U.N. Declaration on the Rights of Indigenous Peoples. Although the particular contours of these rights are complex and varied, and their current authority over aboriginal lands and resources may be in the form of co-management, indigenous peoples are different from other local communities or groups. For example, a decision to impose hunting limits on a species determined to be at risk under severe climate conditions may conflict with tribal rights to take that animal. While there is no simple answer in these cases, conservation officials and policymakers will need to give due consideration to legal issues of sovereignty and self-determination before going forward with an adaptation plan. When indigenous peoples are affected by adaptation strategies taken by other governmental entities, their involvement is likely better understood in terms of "consultation" rather than "participation."[56] **End box**

Experiences over the last twenty years with community-based management and decentralization of resource governance provide important lessons for what role such management can play in adaptation strategies. The Assessment of Impacts and Adaptations to Climate Change (AIACC) project synthesized these lessons into a set of indicators for determining when conditions are appropriate for community-based management for adaptation. They include:

- Maintenance of a diverse and flexible range of livelihood options
- Maintenance or improvement of the production potential of the resource base

[55] INT'L COUNCIL FOR SCIENCE, SCIENCE, TRADITIONAL KNOWLEDGE, AND SUSTAINABLE DEVELOPMENT (2002).
[56] *See generally* MIRJAM MACCHI ET AL., INDIGENOUS AND TRADITIONAL PEOPLES AND CLIMATE CHANGE (IUCN May 2008).

- 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
- Local power relations that are favorable to community based resource management[57]

Discussion of options for community resource management and decentralization is provided in Chapter 11.

Box. Media Campaigns in Peru to Educate and Motivate Adaptation
In the Pirua region of Peru, the government led a Climate Change Press Campaign to bring climate change awareness to the local community and promote adaptive responses to climate change.[58] The Campaign engaged more than 120 local community members, including farmers and fisherfolk and was supported by municipal and regional governments. The goal was to increase awareness in the Pirua community of climate change adaptation and advocate the development of a regional strategy. This effort resulted in several significant accomplishments:

- Regional government enacted a law establishing a technical group to make recommendations on climate change adaptation
- Community resolved to plan for adaptation to climate change
- Information on climate change and adaptation was disseminated through regional media, including to neighboring cities outside the awareness campaign
- The parties developed a regional adaptation strategy

End box

3.4 Building Collaboration into Adaptive Ecosystem Management

Key Point: While science is critical in designing adaptive management projects, local communities and stakeholders who may not have formal scientific backgrounds should also be involved in their design and in making the non-scientific value choices that may be required.

Adaptive management is often presented as a science-heavy, technocratic process. In reality, there is nothing contradictory about including the public, resource stakeholders, community members, business interests, or civil society in adaptive management programs (see Figure X). Adaptive management is designed on scientific principles and should follow the scientific method (e.g., making hypotheses about the ecosystem; designing experiments in management; taking measures to control variables; and rigorous

[57] G.P. VON MALTITZ ET AL., ADAPTING CONSERVATION STRATEGIES TO ACCOMMODATE IMPACTS OF CLIMATE CHANGE IN SOUTHERN AFRICA, S. Africa AIACC Working Paper No. 35, at 27 (2006).
[58] Julio Garcia, *Country Experience in Bottom-up Approach in V&A Assessments*, Presentation at CGE Hands-on Training Workshop on V&A Assessments, Paraguay (2006), *available at* http://unfccc.int/national_reports/non-annex_i_natcom/cge/items/3775.php.

monitoring and information management). And at a minimum, scientific experts should be retained as consultants or facilitators to assist communities in designing their management experiments. However, non-scientists have multiple, essential roles to play in adaptive management:

- Identifying ethical, legal, or rights-based concerns with a proposed management plan
- Identifying interests that will be impacted and trade-offs that may be necessary in carrying out a management plan
- Participating in decision-making about core choices or values (e.g., questions related to ultimate goals and rights-based concerns)
- Using local, traditional, or indigenous knowledge to design hypotheses about the system for testing through adaptive management
- Contributing to the implementation of a management plan through assistance with monitoring, outreach, education, and compliance assurance activities

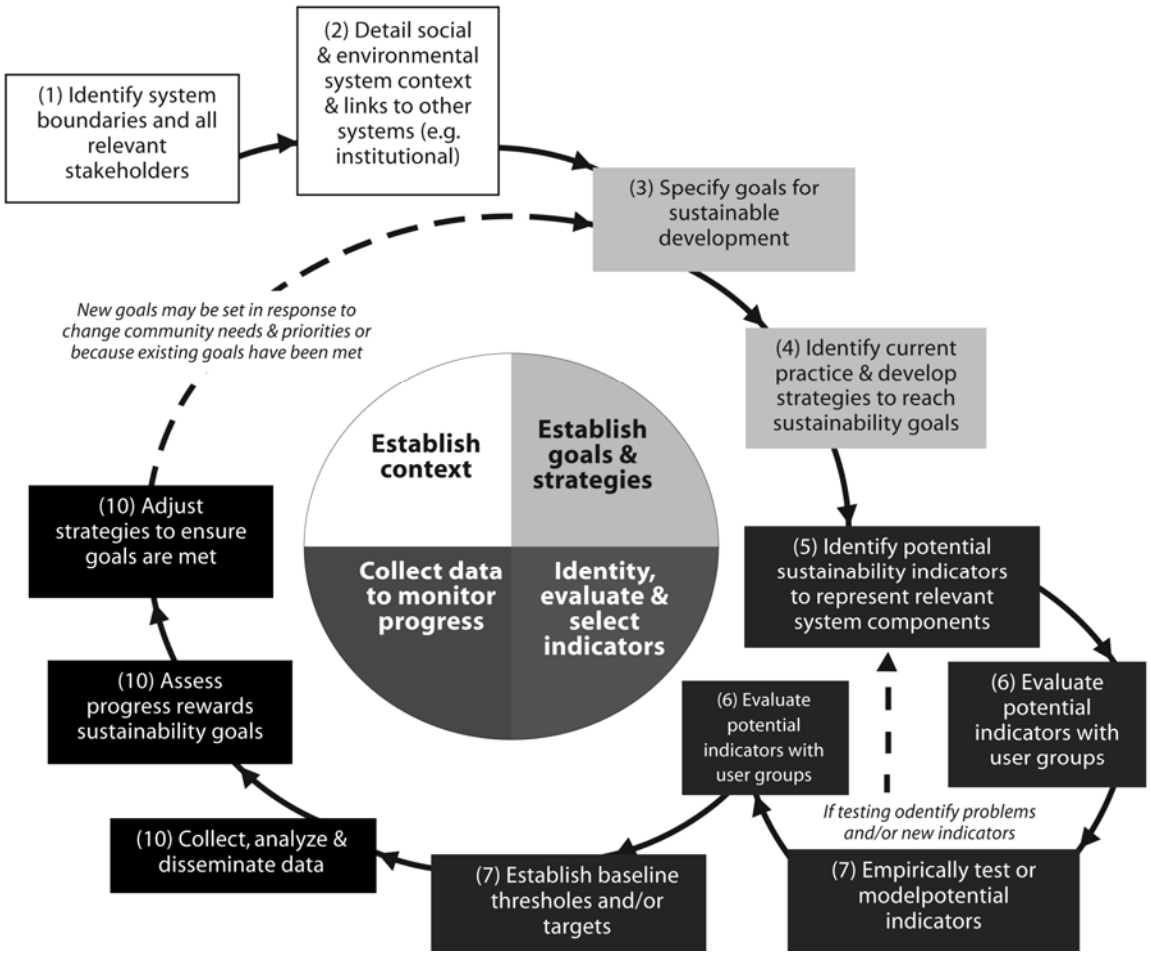


Figure X. This adaptive management model incorporates community and stakeholder values and interests in identifying boundaries, goals, strategies, and indicators. In this model, even the "goals" (Box 3) are adjustable. The ability to revisit and adjust goals and priorities is important but should not be allowed to undermine long-term sustainability

objectives. Adaptive management should be rooted in both science and societal needs and use a process that is itself subject to periodic re-evaluation.[59]

[59] M.S. Reed et al., *An Adaptive Learning Process for Developing and Applying Sustainability Indicators with Local Communities*, 59 ECOLOGICAL ECONOMICS 406 (2006).

Part 2: Legal and Regulatory Options for Adaptive Resource Management

This part presents options for using legal and policy tools to guide adaptive management programs for resilient biodiversity protection in the face of climate change.

At different levels of government, being "adaptive" means different things. A legal and policy structure for adaptive resource management programs will likely rely on mandatory reporting requirements, audits, inspections, compliance and enforcement mechanisms, and other 'hard' legal requirements. These will look very different from the flexibility mechanisms in the management plans they authorize. Frameworks for adaptation through adaptive management create a resilient, feasible, and enforceable legal framework where flexible, adaptive management can take place.

The chapters in this Part are broken down by "functional" area of law. Within any statutory framework there are provisions related to planning and policy setting, management authority, standard setting, enforcement, judicial review, etc. Each of these aspects of a law accomplishes a specific task within the overall framework—it has a "function." The specific language of the provisions related to that function should be examined to see how they may be used (or changed) to allow for effective regulatory planning and response to climate change. Six basic functional areas for adaptation frameworks are explored in this Part.

- **Vision and planning** (defining adaptation objectives and strategies to achieve them)
- **Information management** (establishing historical baselines, identifying information gaps, monitoring, information sharing)
- **Periodic review** (reassessing plans and policies using new information)
- **Coordination of policies and activities** (within government and between sectors)
- Compliance and enforcement (balancing discretion or flexibility with oversight)
- **Enforceable rights and duties** (constitutional sources of law and the role of courts)

Figure 1. Connecting Climate Change, Resource Management, and the Law

Resource	*Climate Change Impacts*	*Management Needs*	*Enabling Laws and Policies*
Marine Fisheries	• Fish species shift in population size and distribution, generally to higher, cooler latitudes • Warming oceans killing coral reefs and associated species • Acidification threatens shellfish and other species	• Real-time monitoring of fish stocks to adjust catch quotas • Protection of spawning areas and other critical habitat from overfishing and other uses • Informing fishermen of safe fishing locations • Control of land use practices to reduce pollution runoff and other land-based stressors	• On-board observer program for catch-limit enforcement and scientific data gathering • Institutional mechanisms for information exchange • Strategic environmental assessment for multi-sector approach to ecosystem services • Marine Spatial Planning that sets aside critical habitat areas

Forestry	• Rising temperatures and drying conditions cause shifts in vegetation types • Loss of canopy species • Emergence of new plant communities • Carbon markets (e.g. REDD) create new mix of incentives for conservation	• Timber permits adjustable based on monitoring for change in indicators such as nutrient and water cycles • Remediation of logged areas targeted to future conditions • Ability to manage areas for ecosystem services other than carbon storage	• Permits contain reopener clauses to adjust terms and conditions, and new information must be considered • Remediation requirements intensify if logging more damaging than expected • REDD frameworks that include social and ecological values
Protected Areas	• Plants and animals migrate out of protected areas and onto non-public lands • Historical ecological relationships unravel; new communities form • Increased pressure to access scarce resources in protected areas by humans	• Authority to protect habitat on marginal lands and lands lacking full protected status • Ability to prioritize protection and restoration activities • Local stakeholder engagement and education to build conservation buy-in	• Long-term targets referenced to future conditions • Statutory instruments for land swaps to protect best habitat • Coordination of private and public land conservation effort • Communities hold secure land tenure to ensure sustainable use • Revenue-sharing with locals
Freshwater Supply	• Extreme fluctuations in water cycles • Lack of water for basic human needs and aquatic and riparian habitats • Flooding and inundation in other areas	• Rationalized prioritization of water uses • Adjustment of water quotas to reflect changing conditions • Protection of aquatic and riparian habitats	• Water-sharing agreements adjust to future flow expectations • Regulation of water usage • Minimum in-stream flow standards to protect habitat
Coastal Zones	• Sea level rise inundates coastal habitat • Increasing storm risks • Erosion undermines coastal structures • Salinization of freshwater aquifers	• Coastal planning incorporates long-term changes in shoreline • Revision of acceptable land uses in high-risk areas • Restoration efforts targeted to future conditions	• Planners required to consider climate change in land use zoning • Insurance programs reflect heightened risk of coastal zones • Rolling easements alter land uses, protect property values

Box. Incorporating Legal and Policy Reform into Adaptation Planning

Many processes are available for countries to assess the role of laws in reducing vulnerability to climate change. The UNFCCC established the National Adaptation Programmes of Action (NAPA) process as a method for countries to assess their vulnerability to climate change and adaptation needs.[60] Guidelines for carrying out NAPAs include policy reform as a "priority activity" and "key adaptation need."[61] The NAPA process could be a valuable instrument for assessing and improving legal frameworks. For example, Uganda's NAPA establishes a project on "Climate Change and Development Planning" that acknowledges natural resources are key to its socio-economic development and proposes to "review existing relevant policies and laws/regulations in relation to climate change" and "develop policy, laws, regulations and byelaws [sic] on climate change."[62]

[60] *See, e.g.*, UNFCCC, National Adaptation Programmes of Action (NAPA), http://unfccc.int/national_reports/napa/items/2719.php (last visited Aug. 27, 2009).
[61] UNFCCC Decision 28/CP.7, Annex §§ 8(c)(ii) & 14 (Jan. 21, 2002), *available at* http://unfccc.int/resource/docs/cop7/13a04.pdf#page=7.
[62] GOV'T OF UGANDA, NATIONAL ADAPTATION PROGRAMMES OF ACTION 65-66 (2007).

The completion of a NAPA is by no means the end of the planning effort. In 2008, the Government of Madagascar convened a workshop, "Assessing the Impacts of Climate Change on Madagascar's Biodiversity and Livelihoods." The workshop participants recommended four main policy actions related to governmental response to climate change. The first is the establishment of an inter-ministerial task force on climate change to facilitate environmentally sound adaptation measures across sectors. This body would be responsible for facilitating the integration of ecologically sensitive adaptation measures across diverse sectors such as mining, oil and gas, tourism, agriculture and fisheries within the Madagascar Action Plan (MAP) – a strategy document developed by the Government of Madagascar to guide development planning in the country and within regional action plans. Second, participants suggested the re-examination and review of Madagascar's Programmes d'Action Nationaux d'Adaptation (PANA) to allow for the integration of data and recommendations emerging from this workshop. Third, the gathered experts highlighted the need to develop a rural development policy around areas most vulnerable to climate change, for which one avenue is updating the Rural Development Policy Letter to integrate workshop recommendations. Finally, participants recommended the development and dissemination of methods of information–education–sensitization on climate change across all levels and sectors.[63] **End Box**

[63] MEEFT, CI, WWF, USAID, MacArthur Foundation, Workshop Report 2008. Special thanks to Lalaina Rakotoson and the Development and Environmental Law Center, Madagascar for this summary.

Chapter 4 Vision and Planning: Creating Scenarios, Setting Goals, and Testing Policies to Allow for Uncertainty

Effective management depends on thorough planning. This is true even within adaptive frameworks that emphasize learning *after* initial plans have been set in motion. Climate change poses a challenge for planners due to the high uncertainty it creates about future conditions. Rather than setting out strategies for the future that respond only to known problems, planning processes can confront the problem of future uncertainty caused by climate change head-on.

This chapter walks through three steps for conservation planning for uncertain futures. *The first step* for planning will be to explore possible future scenarios based on an understanding of trends in the key drivers of change. Once stakeholders and planners have a better sense of the possible futures, *the second step* will be to evaluate current and proposed policies to determine which will likely be most effective over the long term. This information can be used at *the third step* to define core objectives for conservation based on a fuller understanding of feasible outcomes as well as key uncertainties that may undermine those goals. By setting tangible goals for conservation that acknowledge uncertainties, those engaged in planning will set the stage for adaptive ecosystem management. They will transform planning efforts from reactive exercises into forward-looking, implementable strategies for conservation over the long term.

Side box. Planning at National and Local Scales

Most countries already have robust legal authorities in place for conservation planning at both local and national levels. At the national level, for example, the Dominican Republic has developed "la Visión de la Biodiversidad para el 2025," a set of actions and principles for conserving species, habitats, natural areas, and genetic resources by means of sustainable use, as well as laws for protected areas and invasive species. Countries will also be engaged in planning through international programs such as National Adaptation Programmes of Action (NAPA) under the UNFCCC and National Biodiversity Strategic Action Plans (NBSAP) under the Convention on Biological Diversity (CBD). An example of local-scale planning is found in Bhutan's law for forested areas under private or community management. Plans prepared by the person or entity responsible for management must:

- Describe the area and its resources, their uses and their role in the biological diversity of Bhutan
- State the management regime required for the protection and sustainable utilization of the resources, including logging and reforestation requirements and designation of protected areas
- Assess the environmental and socio-economic impact of the proposed management regime[64]

Planning processes such as these can be adapted to foster strategic thinking by assessing the future condition of resources and identifying key uncertainties. For example, if

[64] Forest and Nature Conservation Act § 5 (1995) (Bhutan).

climate change jeopardizes the supply of freshwater because of glacier melt, a community forester in Bhutan may benefit by considering options for dealing with water scarcity. **End Box**

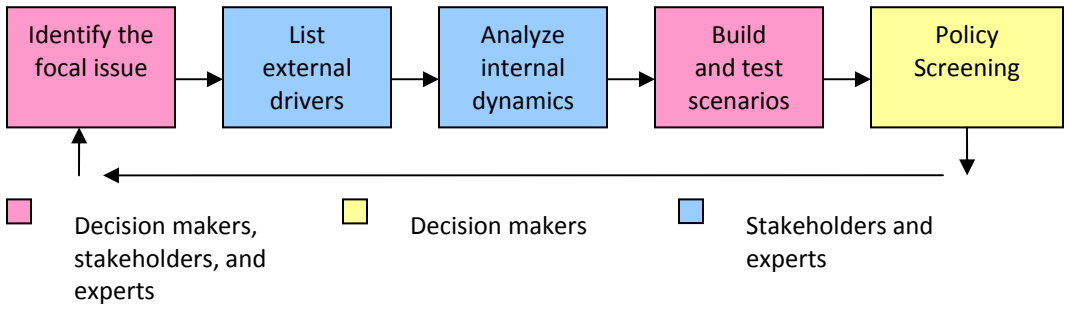
4.1 Step 1: Using Scenario Planning for Long-term Climate Change

Key Point: Scenario planning is a tool that allows policymakers to plan for highly uncertain futures and is thus an ideal approach for planning for complex ecological changes brought about by climate change in combination with other drivers of change.

There are six basic steps to scenario planning:

1. Identification of the focal issue (this can be allowed to emerge from the negotiation of participants)
2. Assessment of system status and function (identifying key indicator variables and uncertainties)
3. Identification of alternatives (identifying multiple ways the system might evolve)
4. Creation of scenarios (framed as an overall narrative that emerges from the interaction of the variables and explicit assumptions about uncertainties)
5. Testing of scenarios for consistency (may involve role playing or interviews in order to determine whether expected behaviors actually occur)
6. Use of scenarios to screen policies (identifying which policies hold up most robustly under the widest range of possible scenarios—in other words, which are the most **resilient** (see Section 4.2 below)[65]

Steps and Participants in the Scenario Planning Process[66]



Scenario planning is not about predicting the future, but rather envisioning several plausible alternative futures and identifying the drivers and the key uncertainties using the best information currently available. Scenario-building exercises should be broadly participatory and use the best available science to construct plausible future scenarios. "The real value may be in the process itself;" these exercises are "conversations designed

[65] Adapted from Gary D. Peterson et al., *Scenario Planning: A Tool for Conservation in an Uncertain World*, 17 CONSERVATION BIO. 358 (2003).
[66] Adapted from Leigh Welling, U.S. National Parks Service, Climate Change Scenario Planning: A Tool for Managing Resources in an Era of Uncertainty (2008).

to help a group of people trick themselves to see past their own blind spots."[67] The goal is to develop alternative management practices depending on which scenario unfolds. Annex II of the U.N. Fish Stocks Agreement provides an example of how to establish this type of framework. It directs parties to define precautionary reference points and then to design alternative management strategies that must be implemented depending on which of those reference points is met.[68]

Side box: "A scenario is a coherent, internally consistent and plausible description of a possible future state …. It is not a forecast; rather, each scenario is one alternative image of how the future can unfold."[69] **End box**

The process of scenario planning should use the best available scientific information, but participants should include a broad range of stakeholders, not just scientists, experts, and officials. As a planning tool, scenario planning can be a key component of adaptive governance. It can be tailored to a specific problem like climate change and focus on decision-making needs, but the exact contours of the scope of planning should emerge from negotiations at an initial stage of the process. Scenario planning can be done at any scale from the local to the international. The Millennium Ecosystem Assessment, for example, developed global scenarios and sub-global scenarios at local (village) and regional levels.[70] Because resource planning affects all aspects of a region's economy and society, planning meetings should be highly participatory.

Case Study Box. Scenario Planning for Ecosystem Services in the Gariep Basin
The Gariep River Basin in South Africa and Lesotho is a rapidly developing, resource rich area that has seen accelerated economic growth, evolution of governance institutions, and increasing strains on natural resources. It is a place of growing inequality between the industrial rich and rural communities closely bound to ecosystems. Through five meetings over two years, a team of scientific experts guided by an advisory group of local resource users from all sectors performed a scenario planning process to explore possible futures for ecosystem services in the area. *First*, the group identified five key services to look at: food production, water, energy from resources, biodiversity, and minerals (due to its importance in resource livelihoods). *Next*, the group identified key drivers of change such as birth rates, urbanization, HIV/AIDS, national policies, wealth distribution, and others. The group developed four possible future scenarios for the Basin:

[67] Leigh Welling, U.S. National Parks Service, Climate Change Scenario Planning: A Tool for Managing Resources in an Era of Uncertainty (2008).
[68] Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, art. 6(3), 34 I.L.M. 1542 (1995); *see also* Daud Hassan, *Climate Change and the Current Regimes of Arctic Fisheries Resource Management: An Evaluation*, 40 J. Maritime L. & Commerce 511, 524-28 (2009).
[69] IPCC, Fourth Assessment Report, Working Group II: Impacts, Adaptation and Vulnerability ¶ 2.4.1 (2007), *available at* http://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch2s2-4.html.
[70] Millennium Ecosystem Assessment, Ecosystems and Human Well-being: Scenarios (2005), *available at* http://www.millenniumassessment.org/.

"Market Forces": Commercial and industrial activity are the main drivers, creating increasing inequalities and loss of biodiversity while mining incomes increase. Societal values favor development and environmental governance declines.

"Policy Reform": Governance improves while foreign investments favoring fair trade and environmental values increase. However, agricultural intensity increases and climate change and water issues are not fully addressed. Ecotourism to Lesotho increases.

"Fortress World": The Basin divides on class lines, and political struggles intensify. Resources are overexploited and conservation efforts plummet.

"Local Resources": Strong civil society networks emerge though national governance is lacking. Despite strong local self-reliance in both economic and conservation matters, environmental quality declines in areas of waste disposal and water treatment.

The qualitative story-telling approach proved to be highly effective at motivating creative and imaginative approaches to policies for collective problem solving. Patterns emerged that were not evident before, such as the key role of trade-offs in present and future use of resources in all scenarios and the importance of considering the impact of drivers at multiple scales (e.g., global climate change interacting with local tourist trends). The process was not intended to result in policy recommendations on specific issues, but follow-up exercises are planned to use scenarios with the intent of identifying and solving specific conservation problems.

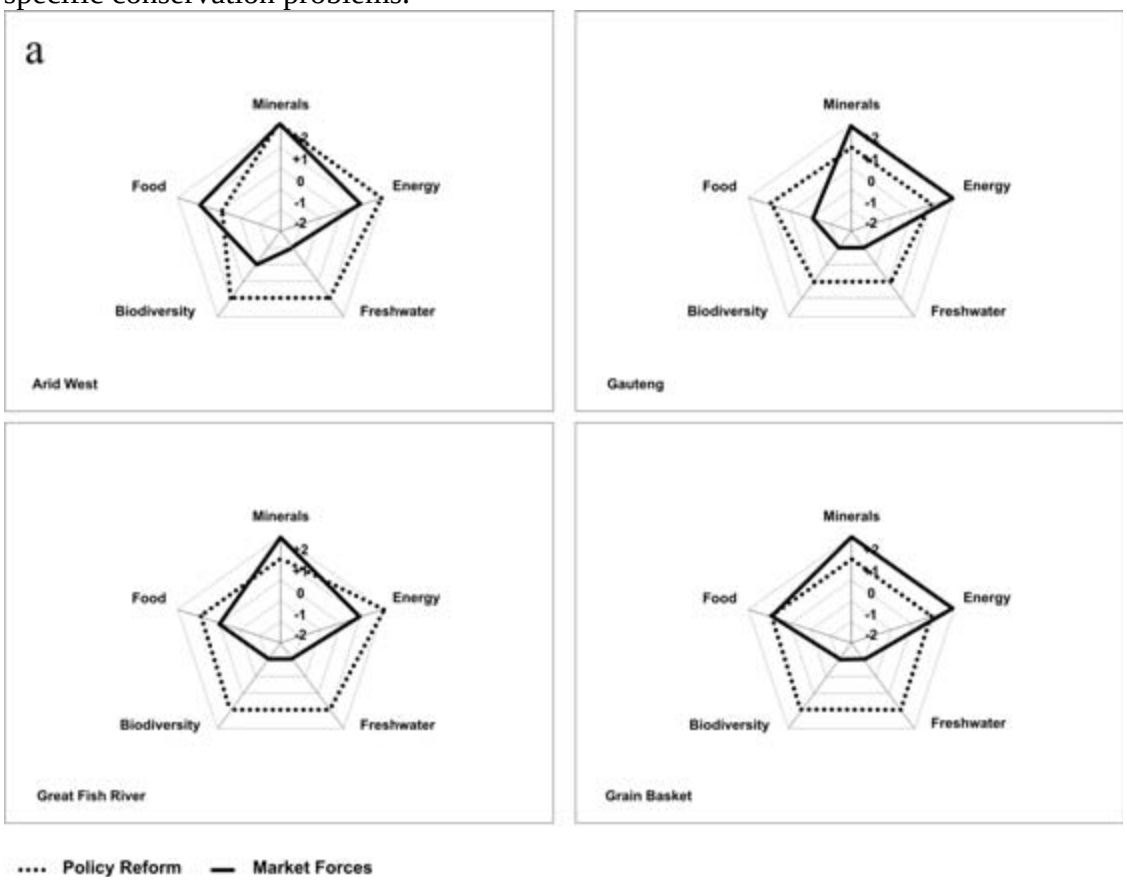


Figure X. Graphic representation of the effect on ecosystem services of two possible scenarios in four regions of the Gariep Basin, developed through the scenario planning process. The amount of change in each service ranges from sharp increase (+2) to sharp decrease (-2).[71] **END BOX**

4.2 Step 2: Developing Resilient Conservation Policies and Objectives

Key Point: Plans that expressly incorporate adaptive strategies such as monitoring, periodic reassessment, and modification will be able to adjust to future conditions. If done properly, scenario planning will reduce the element of surprise when change does occur.

The primary goal of conservation planning for climate change and its uncertainties is resilience. Resilience describes

> persistence of relationships within a system and … a measure of the ability of these systems to absorb changes" and still persist. Thus it can help us to describe the degree of disturbance a system can tolerate …. Resilience expresses the ability of a system to rebound from disturbance and the point at which a disturbance triggers a shift in the structure of the system.[72]

Scenario planning for climate change will produce a set of screened policies that participants have determined are the most resilient (i.e., the most likely to achieve their objectives under the broadest range of possible future scenarios). If done effectively, this will allow decision makers to immediately begin evaluating whether current actions are consistent with the best policy options given future uncertainties, or whether current actions will foreclose resilient policy options in the future. "By building the 'wrong' structures now or by not modifying existing structures, we may actually limit our future options for climate adaptation."[73]

Resilience should be the goal for the ecosystem and its management. Scenario planning is a precursor for adaptive management. It allows participants to identify several policy options, each of which can be implemented through an adaptive management plan, with monitoring and assessment to determine which prove most effective.

4.3 Step 3: Creating a Long-term Vision Based on Resilient Objectives and Benchmarks

---

[71] Case study adapted from Erin L. Bohensky et al., *Future Ecosystem Services in a Southern African River Basin: A Scenario Planning Approach to Uncertainty*, 20 CONSERVATION BIO. 1051 (2006).
[72] Alyson C. Flournoy, *Protecting a Natural Resource Legacy While Promoting Resilience: Can it be Done?*, 87 NEB. L. REV. 1008, 1024 (2009) (quoting C.S. Holling, *Resilience and Stability of Ecological Systems*, 4 ANN. REV. ECOLOGY & SYSTEMATICS 1, 17 (1973)).
[73] SA WATER, IN DETAIL- PERMANENT WATER CONSERVATION MEASURES 33 (2004), *available at* http://www.sawater.com.au/SAWater/Environment/WaterRestrictionsConservationMeasures/PWCM.htm.

Key Point: Strategic planning for climate change should include ultimate, defined management objectives, intermediate benchmarks for reaching those objectives, and reference points to determine when changes in strategy are required.

Scenario planning for climate change is not an alternative to setting tangible goals for improved conservation planning. It is a tool used to set ambitious but feasible goals and then achieve them. Environmental planning under most existing regimes is long on vision but rarely provides a road map to getting there. Broad mandates for sustainability conflict with actual resource-use authorizations in practice.[74] Ideally, in developing national adaptation plans or sustainability visions, countries will also establish *tangible* goals and intermediate benchmarks or "check-points" to ensure those goals are on track to being met. Bhutan, for example, has a visionary concept of "Gross National Happiness" (a holistic concept that incorporates social, cultural, and environmental integrity along with "hard" economic measures like "gross national product") promulgated by Fourth King Jigme Singye Wangchuck that guides the country's development planning.[75] This vision is embodied in a constitutional requirement to preserve in perpetuity 60% (sixty percent) of the country's land as forested areas.[76] With this overarching goal set, Bhutan's forest ecosystems can be managed in a way that allows them to change and evolve over time in response to ecological disturbances like climate change.

Establishing hard deadlines for meeting defined and tangible conservation objectives holds regulatory actors accountable to their commitments. A timeline also gives participants a way to envision the future. This is important for adapting to climate change as it will allow planners to overlay timelines of anticipated climate change impacts onto timelines for achieving conservation objectives. This provides planners a better sense of what management alternatives make the most sense not just in the present but at strategic points in the future.

Example: The Seychelle's National Plan of Action (NPOA) for shark fisheries uses a series of timelines to accomplish objectives. For each of eleven "Work Programmes" to address management needs for the sharks, the NPOA drafters developed a list of recommendations for actions that needed to be taken to address those needs. For each action item under each Work Programme, the planners assigned a "priority" value between "A" and "G" corresponding to a timeframe as follows:

> **A:** Action initiated immediately and completed within 6 months (e.g., develop standardized terminology and nomenclature)
> **B:** Action initiated immediately and completed within 12 months (e.g., develop standardized data gathering methods and user-friendly data charts)

[74] Alyson C. Flournoy, *Protecting a Natural Resource Legacy While Promoting Resilience: Can it be Done?*, 87 NEB. L. REV. 1008, 1022 (2009).
[75] BHUTAN'S FOURTH NATIONAL REPORT TO THE CBD 22 (2009); *see also* ROYAL GOVERNMENT OF BHUTAN, PLANNING COMM'N, BHUTAN 2020: A VISION FOR PEACE, PROSPERITY, AND HAPPINESS (1999).
[76] CONST. art. 5 (2008) (Bhutan).

> **C:** Action initiated immediately with open-ended implementation (e.g., determine if listed species are caught)
> **D:** Action initiated within 12 months and completed in shortest possible timeframe (e.g., develop criteria for sharks to be landed in form that facilitates species identification)
> **E:** Action initiated within 12 months of completion of prerequisite work and completed in shortest possible timeframe (e.g., develop, implement and facilitate prioritized research program)
> **F:** Action initiated and completed within 4 years (e.g., establish mechanisms for the validation of biological, catch, and trade data)
> **G:** Action initiated within 4 years, if not sooner, and completed in shortest possible timeframe (e.g., develop and pilot risk assessment criteria to identify priority shark species)[77]

In order to make timelines enforceable, accountability mechanisms are essential. This might be accomplished through judicial review or removal or transfer of underperforming officials, or through positive incentives such as bonuses for officials or working groups that accomplish objectives on time.

[77] Seychelles National Plan of Action for the Conservation and Management of Sharks 28-33 (2007) [hereinafter NPOA]; examples adapted from Work Programmes 3 (Data Gathering and Management) and 4 (Research).

Chapter 5 Information Management: Legal Mandates for Monitoring and Using Data

Once management plans go into effect, monitoring and information-gathering are critical for adaptive resource governance. They provide decision makers the information they need to know whether current management plans are working as expected or need to be changed. Too often under existing resource laws such requirements are nonexistent, not mandated, unenforced, or unfunded. (The need to actually use the information gathered will be discussed in Chapter 6.) To effectively and sustainably manage a resource under conditions of ecological change and uncertainty *requires* sound and comprehensive monitoring.

This chapter looks at key considerations for legal drafters and policymakers in setting up effective monitoring protocols for resource governance. This includes procedures for establishing baselines and identifying information gaps, determining what will be monitored, where, and at what frequency, and who will do the monitoring. The key consideration of ensuring compliance and enforcement of monitoring requirements is discussed in Chapter 8.

5.1 Establishing Baselines and Identifying Information Gaps

Key Point: Policymakers can give managers regulatory tools, funding, resources, and incentive programs to obtain useful information about how ecosystems evolve in response to climate change. This will better inform all types of management efforts, from rehabilitation of degraded ecosystems to setting harvest quotas for fish or timber species.

The previous chapter discussed the use of scenario planning to identify key indicators and uncertainties driving change in ecosystems. To actually measure change in a system, managers will need to set one or more **baselines.** A baseline is a fixed (often numerical) expression of the status of a resource. Because many resources are already in a degraded state, it is important not only to look at the status of a resource or ecosystem in its current condition, but to include past trends in that resource (see Box, "Setting Baselines Using Deep Historical Records"). Management goals can then be defined by reference to the historical baseline (e.g., at the end of a timber harvest period, there should be 90% (ninety percent) of the baseline population of trees of species X greater than one-foot diameter remaining).

However, climate change in some regions may be so severe over the coming century that the historical baseline for a given resource (e.g., the number of a particular tree species in an area) can no longer be used to establish effective management targets. The ecological system will have changed so dramatically that it is impossible or impractical to try to obtain or restore the baseline. Using the timber harvesting example, climate change may cause the tree species to die out in the management area as conditions change. Managers would find themselves in violation of the conservation target through no fault of their own. While a baseline is essential to the process of defining a conservation target, climate change may require that target to be something other than the baseline status of the

resource. In other circumstances, restoration of historic levels of a resource may indeed be a valid objective where climate change does not render the target impossible in the management area.

Box: Setting Baselines Using Deep Historical Records
Critical for long-term planning in the face of ecological change is a full understanding of the natural cycles of a resource over long time periods in the past. This means that stakeholders and managers should be creative in finding out as much information as they can about the historic population levels of a given species or group of species. An excellent example of how this can be done comes from the Seychelles' 2007 *National Plan of Action for the Conservation and Management of Sharks* (NPOA). Rather than look 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 the journals of sailors in the 1700s who reported that waters around the Seychelles teamed with large and aggressive shark populations. The NPOA then traces the history of 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.

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 "the fishery as a whole [can] be characterized as overexploited and depleted." Armed with the new understanding that the shark populations currently are vastly diminished from the levels present in the marine ecosystems of the area prior to significant human exploitation, the planners could make a determination that strong immediate action was needed. Under Work Programme 5: "Managing Effort in Line with a Precautionary Approach," the NPOA briefly reviews the findings from the baseline survey and states: "This decline … is sufficient to warrant an active and progressive application of a precautionary approach to the management of effort in both targeted and incidental shark fisheries." The NPOA called for legislation within 6 months to establish a strict licensing and catch-limit regime, to prohibit techniques and technologies that over-exploit the sharks, and to close the fishery to new operators for a four-year review period.[78] **End Box**

At the same time managers are determining the historic baseline and appropriate management targets under future conditions, they will also need to identify key **information gaps.** Scenario planning techniques discussed in Chapter 4 are one valuable way to identify information gaps. Managers will also need continuing authority to reassess information needs, especially when new unknown variables emerge. Many agencies may lack the capacity to undertake this task systematically and would view such authority as unnecessary or burdensome" however, several countries' laws make the reassessment of information needs an explicit step in the management process. Under Uganda's environmental impact assessment (EIA) regulations, an EIA must include, among other things, "identification of gaps in knowledge and uncertainties which were

[78] NPOA, supra note X, at 34.

encountered in compiling the required information."[79] Legal regimes structured around the principles of adaptive management can provide an avenue by which regulators identify information gaps and then begin filling those gaps in the course of implementation. Thus, the Mexican regulation for shark fisheries management (see case study box at end of Chapter 3) makes clear that there are many unknown factors related to biological and environmental conditions, fishing technology, and cultural and economic needs that require further study. The regulation directs Mexico's fisheries authority to consult with all stakeholders, including state and regional governments, non-governmental environmental organizations, and the fishing industry to set goals for answering these questions during the management process.[80] Without an awareness of what is unknown and a process to find the answer to those questions, management may proceed on the basis of ecological assumptions that will be false due to climate change. Identifying and reassessing information gaps are initial steps.

5.2 Choosing Indicators for Targeted Monitoring

Key Point: Indicators for monitoring set by statute, regulation or management plan should include climate-related changes in the environment in order to provide resource managers and users the fullest understanding of the dynamic systems they use and rely on.

Monitoring the effects of climate change on an ecosystem is much easier when managers identify a list of **indicators** rather than attempt to monitor all facets of the system. Indicators, or "metrics," are measurements of a specific, narrowly defined ecological phenomenon that provides information on the status of the larger ecosystem. By identifying key indicators, managers can learn a good deal about an ecosystem without expending enormous resources trying to keep track of every observed change in the system.

Identifying indicators is largely a place- and resource-based exercise. For example, officials in Canada are monitoring the growth rings on Blanding's turtles in order to predict the impacts of climate change on turtle population levels several decades into the future.[81] In addition to ecosystem indicators such as this, at the national level monitoring increasingly needs to include climate indicators, including but not limited to:

- Temperature patterns (especially extremes)
- Precipitation patterns
- Storm activity and extreme weather patterns
- Changes in ocean and freshwater chemistry
- Changes in species' growth patterns and geographic distribution

This monitoring will likely be conducted by a governmental, academic, or international scientific body. The imperative is to get this information to the public and stakeholders quickly, along with recommendations for preparation and response.

---

[79] Uganda, Environmental Impact Assessment Regulations 1998, No. 13, art. 14(h), (j), & (k) (Statutory Instruments Supp. to the Uganda Gazette No. 28 volume XCI dated 8th May, 1998).
[80] NOM-029-PESC-2006, supra note X, § 0.16.
[81] Cliff Drysdale et al., *Climate Change and Adaptive Resource Management in the Southwest NOVA Biosphere Reserve, in* CLIMATE CHANGE AND BIODIVERSITY IN THE AMERICAS 231, 245 (2009).

Officials and managers setting up monitoring systems must also be sensitive in choosing the most effective locations for monitoring to track climate change impacts on resources. Comprehensive monitoring takes into account both spatial (geographic location) and temporal (time period) variability in ecological indicators. The CBD recommends, "Design monitoring system on a temporal scale sufficient to ensure that information about the status of the resource and ecosystem is available to inform management decisions to ensure that the resource is conserved."[82] Monitoring requirements can be further tailored to the specific needs entailed in managing a particular resource, ecosystem, or species. For example, monitoring efforts to detect new infestations of invasive species might be focused along conduits that may open up as a result of climate change, such as high mountain passes, or formerly ice-bound shipping routes.[83]

Example: Kenya's framework environmental law contains a broad monitoring mandate. It requires monitoring to be performed for "environmental phenomena with a view to making an assessment of *any possible changes in the environment and their possible impacts*."[84] This includes a "baseline survey to identify basic environmental parameters in the area before implementation" and a "measurement of environmental changes that have occurred during implementation."[85] These requirements for monitoring go beyond impacts caused by the project itself, allowing consideration of the effects of climate change. However, the breadth of the law is likely unworkable given limited agency resources. Identifying a limited set of indicators of environmental change for monitoring may be more feasible.

5.3 Deciding Who Does the Monitoring

Key Point: Dedicated authorities, resources, institutions, and funding are necessary to collect data and interpret how climate change is impacting ecosystems. Government partnerships with academic institutions, civil society, or community-led monitoring programs can be formalized through official, signed agreements.

A variety of actors can do environmental monitoring. Often under existing laws the permit holder or resource user reports environmental information to authorities. These reporting requirements are important and undergird much environmental law. However, these government required reports may not be sufficient to capture large scale changes in the environment caused by climate change because they are limited to particular processes or geographic areas. Dedicated institutions, resources, and funding are essential to collate, synthesize, and analyze raw data and interpret what it means.

---

[82] CBD SECRETARIAT, ADDIS ABABA PRINCIPLES AND GUIDELINES FOR THE SUSTAINABLE USE OF BIODIVERSITY 12 (2004).
[83] *See* ENVTL. L. INST., HALTING THE INVASION: STATE TOOLS FOR INVASIVE SPECIES MANAGEMENT 10 (2002).
[84] Kenya Environmental (Impact Assessment and Audit) Regulations art. 40.1(a) (Legal Notice No. 101, Kenya Gazette Supp. No. 56, June 13, 2003) (emphasis added).
[85] *Id.* art. 40.1(c) & (e).

Example: Vietnam is addressing this concern in its fisheries program. Provincial departments had been unable to fund monitoring and lacked information related to marine resources, stock status, and conditions of the habitats around fishing grounds. The primary source of information was from permitted fishing vessels, which officials knew to be unreliable.[86] In 2007, Vietnam established a national-scale program with funding to identify and monitor key ecological indicators for land, wetlands, freshwater, and the ocean—giving officials an independent view of the status of marine resources.[87]

While resource users can provide valuable localized information, user-level reporting requirements should be supplemented with other sources of ecological data. International efforts like UNEP's World Conservation Monitoring Centre[88] and the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES)[89] can provide valuable information, resources, and guidance. NGOs, local communities, and academic institutions are also ideal for this work.

Box. Using On-Board Observers to Monitor Fisheries in the Solomon Islands
Deep-sea fisheries pose a challenge in ensuring compliance with the law and providing accurate monitoring and environmental reporting on ecological indicators. Many countries are turning to the use of on-board observers to ensure data collection is accurate and to report violations of fishery laws. Care must be taken to protect the integrity of observers and their work. Observers do not usually go on every ship and do not have enforcement powers.[90] The Solomon Islands Fisheries (Foreign Fishing Vessels) Regulations provide a model provision requiring access to boats by on-board observers as a condition of each foreign fishing operation permit. The conditions include:

- Observers are permitted to board or leave the ship as required by a head fishery official, including at ports of voyage commencement or unloading outside the fishery area
- Vessels must provide maintenance for the observer including food, accommodation and medical care of a standard equivalent to that provided for officers of the vessel
- Vessels must allow the observer to observe and record any or all aspects of the fishing operations and allow her access to:
    - the catch on board and at unloading in order to obtain management related or biological information and samples;

[86] WORLD BANK & VIETNAM MINISTRY OF FISHERIES, FISHERIES REPORT 13 (2005), *available at* http://siteresources.worldbank.org/INTVIETNAM/Resources/vn_fisheries-report-final.pdf.
[87] Master Planning of National Monitoring Network of Natural Resources and Environment until 2010, issued by Dection 16/2007QD-TTg (Jan. 29, 2007).
[88] http://www.unep-wcmc.org/ (last visited March 18, 2010).
[89] *See* Governing Council of the United Nations Environment Programme, Report of the Executive Director, Intergovernmental Science-policy Platform on Biodiversity and Ecosystem Services, UNEP/GCSS.XI/7 (Nov. 19, 2009); *see also* IPBES, http://ipbes.net/en/index.asp (last visited March 18, 2010).
[90] For more information about the Pacific Islands Forum Fisheries Agency (FFA) and its regional observer program, of which the Solomon Islands are a member country, see FFA, Observer Program, http://www.ffa.int/observers (last visited August 5, 2010).

- the daily catch records
- charts and navigational records
- communication channels with the Principal Licensing Officer for the purpose of his duties
- such other facilities and equipment as may reasonably be required to enable the observer to carry out her duties[91]

This program improves legal compliance on the high seas and provides information on marine resource trends caused by climate change and other factors.

On-board observers monitor compliance with fisheries regulations. The data they collect can also be used to track changes in marine ecological indicators.[92]

End Box

Monitoring of ecological conditions is an appropriate task for academic institutions because they will already be interested in such data for research purposes. These efforts are enhanced by engaging the local community and lay volunteers, especially for monitoring of indicators that do not require high levels of scientific expertise. Monitoring programs can effectively employ volunteers with a minimum of training, but the following guidelines may improve the effort:

- Lay persons or volunteers can be trained through workshops to ensure participants understand methods of monitoring, and processes for transmitting data.[93]
- Participants should meet at regular intervals to guarantee that they share a clear understanding of the goals, objectives and steps of the project. Mutual respect and transparency are essential.[94]

[91] Solomon Islands Fisheries (Foreign Fishing Vessels) Regulations § 23, art. 7 (LN 84/1983), *available at http://www.paclii.org/sb/legis/consol_act/fa110/*.
[92] Pacific Islands Forum Fisheries Agency, Observer Program, http://www.ffa.int/taxonomy/term/446 (last visited July 16, 2010).
[93] NATIONAL BOTANICAL INSTITUTE, S. AFRICA, C.A.P.E. THREATENED PLANTS PROGRAM 6 (March 2007), *available at* http://www.cepf.net/Documents/Final_NBI_ThreatenedPlants.pdf.
[94] FRIENDS FOR CONSERVATION AND DEVELOPMENT, DEVELOPING AN INTEGRATED STRATEGY AND PROJECT PLAN TO CONSERVE THE CHIQUIBUL/MAYA MOUNTAIN KEY BIODIVERSITY AREA IN BELIZE 6-7 (June 15, 2006), *available at* http://www.cepf.net/Documents/Final.Friends.of.conservation.pdf.

- Seminars can facilitate exchange of ideas between researchers and monitoring teams in different regions. They can be held at regular intervals to sustain a community of practice and provide a forum for exchange of new ideas.[95]
- Funding through government appropriations or grants may be necessary to ensure volunteers have effective equipment and support to guide their efforts.

Box. Climate Monitoring Partnerships with Communities

Central governments often lack the resources to undertake the widespread, intensive monitoring necessary to keep track of regional climate impacts. Because local resource types, vulnerabilities, and anticipated impacts are diverse, programs to monitor the local environment for the effects of climate change are appropriate for partnerships with civil society, communities, and even businesses with operations in the area.

Local communities will be intimately familiar with weather patterns and indicator phenomenon that can be used to detect and predict changing patterns. These observations may be as small as the location of an ant hill or as large as the shifting of the tide. When given an information-gathering role, local actors feel empowered and gain knowledge of local resource vulnerabilities, adaptation strategies and programs, and protective mechanisms. The role of the coordinating organization (whether an NGO, international agency, business, or other group) includes:

- Communicating with local community
- Providing technological knowledge and information transfer
- Assisting with funding and support

In Nicaragua, for example, "early warning systems" are being set up with indigenous communities to help them respond to climate change. This process is supported through a partnership between Oxfam, Acción Médica Cristiana (CMA), Centro Humboldt, and indigenous authorities. The partnership trains local communities to measure rainfall and provide data on variations in river levels in real time. Data is radioed to national weather and climate institute to mitigate or prevent direct consequences of a hurricane and subsequent flooding. "[T]he Early Warning System will help them to match the new patterns of rain, temperature and natural behavior with external signs … in order to understand better what is happening and how they can interact with nature."[96]

[95] CitiesACT, http://www.citiesact.org/training_courses.aspx; Better Air Quality 2008, http://www.baq2008.org/; Yoshitoku Yoshida, Background and Objectives of Environmental Monitoring of POPs in East Asian Countries, http://www.env.go.jp/chemi/pops/3rd/mat02.pdf.

[96] Oxfam, A Tool against Climate Change…and Hurricanes, http://www.oxfam.org.uk/oxfam_in_action/where_we_work/nicaragua/early_warning.html (last visited October 30, 2009).

A flood gauge for community weather tracking in Nicaragua.[97] **END BOX**

[97] Oxfam, Dealing with Disasters, http://www.oxfam.org.uk/oxfam_in_action/where_we_work/nicaragua.html (last visited July 16, 2010).

Chapter 6 Periodic Reviews: Mandates for Effective Reviews and Adjustments

Mandates to systematically review and reevaluate policies and decisions affecting resources build adaptive capacity for climate change by allowing quicker responses to changes in conditions and new information. They can be built into all levels of management, from technical regulatory standards up to legislation itself. Mandates to review and reevaluate the highest levels of a country's laws is especially important in order to respond to fundamentally new and different challenges arising from the ecological disruptions caused by climate change. For example, requiring or emphasizing restoration of ecosystems to a historical status may result in programs that fail to consider future climate impacts, undermining restoration efforts. Reviewing laws periodically ensures that such "maladaptive" policies are assessed and revised in a timely manner.

This approach to governance benefits when policymakers openly admit the limitations of their ability to know in advance the conditions and challenges faced in the future, and whether and to what extent legal and policy efforts in the present will accomplish their intended goals. Uganda's Law Reform Commission Act of 1990 presents an example of an institutionalized framework for reviewing and updating laws and policies in light of new understandings and circumstances. The law establishes a Law Reform Commission charged with the task to:

> study and keep under constant review the Acts and other laws comprising the laws of Uganda with a view to making recommendations for their systematic improvement, development, modernisation and reform with particular emphasis on …the development of new areas in the law by making the laws responsive to the changing needs of the society in Uganda.[98]

With specific legislative direction or regulatory guidance, this body could play a key role in reviewing and making recommendations for adapting to climate change in Uganda. This chapter discusses the use of review requirements to adapt resource legal frameworks to climate change.

6.1 Building Continuous Decision-making Processes and Institutions

Key Point: Periodic review points are used to evaluate knowledge about the ecosystem, current trends, and emerging threats. With this information at hand, adjustments in strategy can be made. The discretion to make changes, however, should be constrained by the needs of stakeholders and the ecosystem.

Reviews of implementation in natural resources management are certainly not new legal tools. Like existing monitoring requirements, however, they have often been ineffective because the mandate to undertake reviews is rarely accompanied by specific regulatory instructions on how to perform them or resources and funding to ensure the reviews

[98] Law Reform Commission Act, cap 25, § 10 (1990) (Uganda) (emphasis added), *available at* http://www.saflii.org/ug/legis/consol_act//ulrca284/.

produce meaningful results. The result has been that much law governing biodiversity relies on "front-loaded" decision making with little "back end" follow through.

"Front-loaded" decision-making regimes are those in which choices made at the beginning of a project or implementation of a policy cannot be rethought or modified to reflect new information or changed circumstances later on. The uncertainty inherent in predicting future environmental conditions due to climate change means regulatory actors need authority to make **mid-course corrections.** Donor-funded projects with heavy conditions and large-scale development work may be difficult to adjust after initial implementation. In such cases it may be more appropriate to use review points to determine if additional mitigation measures should be implemented, rather than to halt or reverse the project outright.

Effective programs of review and oversight might include the following elements:

- A representative body (or bodies—see example below) legally empowered to meet regularly and assess the status of management efforts and new trends in the ecosystem
- Transparent procedures of operation, including clear rules on what is and what is not within the discretion of the body to change (if part of a fully active adaptive management program, this will mean tying the reviewing body's discretionary authority to the benchmarks or reference points that trigger changes in management strategy, such as reduced harvest quotas)
- Sufficient financial resources, technical capacity, and human resources to support the reviewing body's ability to meet its mandated obligations (funding might come through fees or excise taxes levied on resource users, government general funds, or the international donor community)

Example: In Bolivia, each protected area within the National Service of Protected Areas (*Servicio Nacional de Areas Protegidas*, or SERNAP) has a Director, Technical Council, Management Committee, Advisory Council, and a Protective Body.

- The **Technical Council** is the body responsible for implementing the Management and Annual Operational Plans within the protected area.[99]
- The **Management Committee** functions like a board of directors, with 6 to 10 representatives of indigenous groups, social organizations, and local municipalities or prefectures. At least 50% of the members must be from indigenous groups and all must have "a proven track record" of biodiversity conservation work. This committee participates in the development, implementation, and evaluation of management and operational plans and works to integrate local communities into such considerations.[100]
- The **Advisory Council** is a group of five to eight scientists and specialists that advise scientific research activities in protected areas and provide expertise on issues related to the management of SNAP areas. [101]

[99] Supreme Decree No. 24,781, arts. 41, 45, 47, 54, 59 (1997) (Bolivia).
[100] *Id.* arts. 47-53.
[101] *Id.* arts. 54-58.

- The **Protective Body** is the functional arm of the National Protection System (*Sistema Nacional de Protección*, SNP), a set of rules and procedures designed to regulate, organize, train, and monitor protection activities in protected areas. Each area, through its Protective Body, is required to develop and implement a Protection Strategy to analyze emerging threats to the area.[102]

6.2 Reviews Set at Periodic Intervals or by Triggering Events

Key Point: Resource laws that provide frequent, mandatory review points allow for quicker responses to new and emerging threats from climate change. Reviews can be set at periodic intervals (e.g., every year), and they can be set when thresholds are crossed (e.g., when a species population is reduced below a certain number).

A **policy lag** occurs when policymakers are aware of a problem but fail to address it. These lags can be reduced significantly through institutional bodies dedicated to assessing the effectiveness of conservation efforts. Reasons for extended lag times between identification of a problem and its solution through changes in policy may include:

- Lack of technical and scientific understanding necessary to define the problem and provide solutions
- Actors who do not share a common understanding of the issue
- Actors who share common understanding, but are otherwise intransigent
- Intervening distractions that push the issue lower on policymakers' lists of priorities[103]

To reduce policy lag times, policymakers may institute methods to periodically assess the status of a resource, 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).

Reviews can also be triggered by certain "threshold" events. For example, when a species population drops below a certain level, this may trigger a meeting of a managing body to determine what new measures are needed. This approach has the benefit of triggering immediate meetings and action when a change is observed, rather than waiting for the periodic review date to come up. However, if no triggering events occur, it may cause the period between reviews to lengthen to such a degree that, if anything is happening to the resource that is not being observed, it may be overlooked until it is too late to take effective responsive action.

[102] *Id.* arts. 2, 59-65.
[103] Adam B. Smith, *International Biodiversity Conservation 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).

A combination of periodic review points that go over all available information and new concerns, coupled with a system of threshold triggers, may be the best way of ensuring that all possible threats to a system are detected and acted upon as early as possible.

Example: In considering whether to reapprove environmental impact assessments (EIA) in Uganda, the relevant official is called upon to consider "the validity of the predictions made in the environmental impact statement."[104] Approval may be revoked "where there is a substantive undesirable effect not contemplated in the approval."[105] These powers can facilitate responses to climate change well after a project has been initially approved. These types of provisions are sometimes referred to as "reopener clauses" because they can "open up" a previous approval or authorization for review and possible revocation. They can provide important authority for managers seeking to act adaptively or respond to circumstances different from those at the time an EIA was adopted. It may be that a reopener is required prior to a formal review point if impacts are worse than anticipated. Thus some redundancy, such as a list of triggering events that force an early reopener, may help bolster the power to make mid-course corrections. Reopeners are discussed in greater detail in section 10.2.

[104] Uganda, Environmental Impact Assessment Regulations 1998, No. 13, art. 24(1)(a) (Statutory Instruments Supp. to the Uganda Gazette No. 28 volume XCI dated 8th May, 1998).
[105] *Id.* art. 28(1)(c).

Chapter 7 Coordination of Policies and Activities: Integrating Adaptation Efforts across Institutions

Climate change affects many different types of natural resources. Because of this, climate adaptation requires significant improvements in coordination and integration of management efforts among existing institutions and stakeholders. These measures move resource governance closer to the "ecosystem management" model discussed in Chapter 1.3. This chapter looks at two primary types of relationships that should be strengthened in order to improve the transfer of information and the coordination and integration of policy objectives and management efforts. Those relationships are:

1. Among actors within government, including between different agencies, within the same agency, or at different levels of government (local, provincial, and national).
2. Among different economic sectors such as water, agriculture, and mining.

Strengthening these relationships facilitates an integrated approach to climate adaptation by building "diagonal" networks to govern ecosystems that cut across bureaucratic categories ("horizontal" integration) and that open up lines of communication between stakeholder groups to increase participatory governance ("vertical" integration).[106]

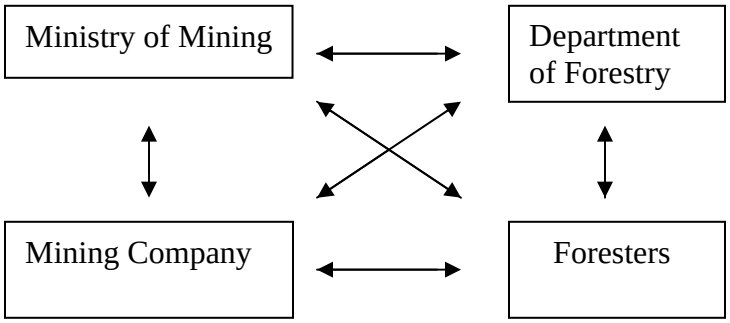


Figure X. Building diagonal networks provides institutional capacity for engaging all relevant actors, ensuring policies are coordinated and consistent across sectors and levels. Such networks are facilitated by periodic meetings to discuss activities or projects, and liaison offices dedicated to ensuring cross-cutting issues like climate change are handled in each department's internal processes.

7.1 Coordinating within Government

Key Point: By establishing permanent institutions, offices, positions, and processes for coordinating multiple agencies' policies and activities, governments can evaluate and improve the effectiveness and consistency of adaptation policies.

[106] The concept of 'diagonal regulatory initiatives' is presented in Hari M. Osofsky, *Climate Change Legislation in Context*, 102 NW. U. L. REV. COLLOQUY 245 (2008); *see also* Burns Weston and Tracy Bach, Recalibrating the Law of Humans with the Laws of Nature: Climate Change, Human Rights, and Intergenerational Justice, appendix B, recommendation 9 (2009).

Given the cross-cutting nature of climate change impacts, interagency coordination is essential to ensure ecologically-resilient livelihoods and communities. Regulatory programs administered by agencies with interrelated or overlapping mandates (such as an oil leasing agency and a forestry department charged with stewardship of adjoining pieces of land) can be used as a starting point for encouraging regulatory actors to collaborate to find solutions to common or cross-cutting problems.[107] In addition, a framework of environmental information collection improves decision-making by building up a publicly available record on what worked and what did not. This allows for adaptive management and planning on a larger scale than a single project- or resource-specific issue as officials and the public are able to evaluate new proposals by referring to a wider administrative and regulatory history.

Options to improve coordination may be available under **existing** institutional structures, which can be strengthened by new authorities or legislative initiatives. Such options for policymakers to improve coordination within existing regulatory systems include:

- Appoint inter-agency contact persons (liaisons) to coordinate on cross-cutting climate change adaptation issues
- Assign responsibility to each line ministry to consider climate change in activities and programs (e.g., through use of environmental impact assessment (EIA) and strategic environmental assessment (SEA))
- Establish regional coordinating bodies that streamline existing legal authorities and regulatory institutions

Policymakers could also establish **new** structures, organizations, or agencies to improve coordinated planning on climate adaptation, such as a:

- Climate Change Service (a non-regulatory and information-focused service that maintains early warning systems, provides reports on indicators for resource users, maintains easy-to-use, publicly accessible database of raw data, records, reports, and other publications)
- Minister of Climate Change (a ministry position with a public figurehead that has regulatory responsibilities and establishes adaptation as top government priority)
- Committee on Climate Change + Adaptation Sub-committee (a separate group that ensures greater independence although with some loss of democratic accountability that develops recommendations and may oversee a program of work carried out by other agencies or industry actors)
- International Adaptation Secretariat (e.g., a treaty organization to facilitate cooperation on adaptation strategies across national boundaries)

Laws that require a **strategic environmental assessment** (SEA) are powerful tools for coordinating climate change adaptation efforts. SEA helps integrate environmental considerations into policies, plans, regulations, legislation, and programs and helps evaluate how those considerations link with economic and social concerns. By guiding

[107] Arlene Kwasniak, *Environmental Assessment, Overlap, Duplication, Harmonization, Equivalency, and Substitution: Interpretation, Misinterpretation, and a Path Forward*, 20 J. ENVTL. L. & PRACTICE 1 (2009).

the development of high-level government planning and activities, SEA can complement and enhance a project-specific environmental impact assessment (EIA) by ensuring that project proposals are set within a fully integrated national-level impacts analysis.[108] SEA uses a range of analytical and participatory approaches that can be adapted to a country's governance context and needs.[109] SEAs are meant to close gaps in legal frameworks by providing environmental analysis of a country's existing development plans and by establishing procedures for assessing the impact of climate change on higher-level government actions. Kenya defines SEA as "the process of subjecting public policy, programmes and plans to tests for compliance with sound environmental management."[110]

Caption: Tropical glaciers in Peru's Andes could be gone by mid-century. Loss of this vital water source impacts multiple sectors and populations and will require a unified regional response.[111] **End Caption**

Examples: In Bhutan, an assessment of the capacity of its national legal frameworks to confront climate change might take place under the Regulation on Strategic Environmental Assessments (RSEA), which requires that "cumulative and large scale environmental effects are taken into consideration" in government policy making.[112] These effects are "built up incrementally over periods of time, result from the addition and interaction of multiple activities and stresses, and are pervasive, cutting across policy sectors and ecological boundaries."[113] By undertaking SEA, a government gains a holistic view of its capacity to preserve and enhance the biodiversity of its natural resources under future climate change scenarios.

---

[108] *See generally* ORGANIZATION FOR ECONOMIC CO-OPERATION & DEVELOPMENT (OECD), APPLYING STRATEGIC ENVIRONMENTAL ASSESSMENT: GOOD PRACTICE GUIDANCE FOR DEVELOPMENT CO-OPERATION (2006), *available at* http://www.oecd.org/dataoecd/4/21/37353858.pdf.
[109] *Id.* 24-25 (2006).
[110] Kenya Environmental (Impact Assessment and Audit) Regulations art. 2 (Legal Notice No. 101, Kenya Gazette Supp. No. 56, June 13, 2003).
[111] Clean Economy Blog (February 18, 2009), http://www.cleaneconomy.it/magazine/?tag=climate-change (last visited July 16, 2010).
[112] Regulation on Strategic Environmental Assessments art. 1.2 (2000) (Bhutan).
[113] *Id.* art. 3.2.

General environmental framework laws can enable cross-scale, "diagonal" governance through information dissemination. Liberian law establishes a national monitoring system involving relevant government authorities "that provides regular reports for polluting facilities, industries and activities in Liberia."[114] In general, the environmental authority is to "enter into consultation with other State Agencies in the region and develop Action Plans for the co-operation and harmonization of the management of shared natural resources."[115] The law also establishes the environmental agency as a "clearinghouse" of environmental conventions and agreements and as such must "coordinate activities related to these instruments in Line Ministries, State agencies and non-governmental organizations."[116] Implementing these programs is a continuing challenge for Liberia.

Box. Developing a Multi-Agency Adaptive Aquatic Species Program in Vietnam

Vietnam provides one example of a forward-looking attempt at integrated, holistic management of 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").[117] 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 foundation," and calls for the fisheries sector to be developed sustainably. The Scheme's objective is to limit threats to aquatic species "in a community-participatory approach."

During 2008-2010, the Scheme establishes a database system that lists precious and rare aquatic species and information about them. Further, the Scheme establishes a system of "operation zones" of protection in inland water reserves for threatened, endemic aquatic species. These zones are to be "buil[t] on an experimental basis" and they are region-specific. For example, eel species, especially *Anguilla marmorata* located in the lower stretches of the Ba and Huong Rivers, are managed under a special plan.

The Ministry of Agriculture and Rural Development and provincial/municipal People's Councils are responsible for implementation, with funding provided by the central government. 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.

[114] Environment Protection and Management Law of the Republic of Liberia art. 34 (approved Nov. 26, 2002).
[115] *Id.* art. 98.
[116] *Id.* art. 99(3).
[117] Information in this paragraph from Prime Minister's Decision 485/QD-TTg, Official Gazette Issue Nos. 03-04, at 30-34 (May 2, 2008) (Vietnam).

Caption: The Tam Giang-Cau Hai lagoon in the Huong River Basin is a World Heritage Site and also home to thousands of impoverished fishing and farming communities. The lagoon is highly vulnerable to climate change impacts like salinity intrusion and increased erosion. However, an anti-salinity weir to protect aquaculture is fragmenting freshwater habitat.[118] Vietnam's new plan to coordinate management of aquatic species may improve adaptation decision-making in the future.

Importantly, the Scheme is not a law itself. Rather, it implements several regulatory programs through a long-term, master project that consists of many smaller, more specific targets that all operate to achieve a final result. Each provincial agency implements the Scheme following its existing legal authorizations, which are 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 caused by fragmented regulatory authorities. ("Stove piping" occurs when separate but related regulatory processes go forward without coordination between them.) Here a centralized program authorizes the relevant agencies at each level of government to coordinate activities to implement a single, overarching management scheme for aquatic resources. While the results of this arrangement are still forthcoming, this may be an important model for integrated policies to respond to climate change, given the need to coordinate actions among the many agencies that will likely develop adaptation strategies for complex climate change problems such as sea level rise. **End Box**

7.2 Incorporating Adaptation Strategies across Sectors using Environmental Impact Assessment (EIA) Laws

Key Point: Environmental Impact Assessments (EIA) can guide decision making on projects impacting natural resources that are likely to be affected by climate change. An

[118] *See* Netherlands Climate Assistance Program (NCAP), Climate Change Impacts in Huong River Basin and Adaptation in its Coastal District Phu Vang, Project Work Plan (2005), *available at* http://www.nlcap.net/fileadmin/NCAP/Countries/Vietnam/NCAP_workplan_Vietnam_summary.01.300106.pdf ; WikiADAPT, Methodology of the Vietnam NCAP Project, http://wikiadapt.org/index.php?title=Methodology_of_Vietnam_NCAP_Project (last visited July 16, 2010); photo attributed to user "tu geo" on flickr.com.

EIA system that captures and accounts for climate change in economic development and natural resources decision making should use an impacts analysis that considers: (1) the viability and cost of a project under a range of climate scenarios; and (2) the impact of the project on an environment undergoing climate change.

Climate change is a stressor that cuts across multiple sectors. It is therefore important to consider the effect of climate change on projects and activities that may be outside the context of biodiversity protection and natural resources management but that nonetheless impact natural resources. These include large infrastructure projects such as dams and highways, commercial development projects, mining operations, residential subdivisions, agricultural practices, and many others. A key tool for **"mainstreaming"** climate change planning (making it a systematic part of the process of the development of these types of projects) is through environmental impact assessment (EIA). Climate change information may be necessary in order to make an environmentally sound decision about a proposed project or policy, and therefore a strong legal argument can be made that the information must be included in the EIA. A useful model for making climate change issues a part of an EIA may be found in guidance issued by the U.S. government on how to consider projected climate change effects for EIAs under the National Environmental Policy Act.[119] Guidance materials on how to undertake a Vulnerability Assessment of proposed actions may also prove helpful in analyzing how climate change considerations can be integrated into the EIA. (See box on this topic at Section 1.1).

Box. EIA for Biodiversity and Climate Change

Requirements to undertake EIAs are included in treaties on both climate change and biodiversity protection.

- The U.N. Framework Convention on Climate Change (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 EIA to reduce "adverse impacts on the economy, on public health and on the quality of the environment."[120]
- Article 14 of the 1992 Convention on Biological Diversity states that contracting parties "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."[121]
- The U.N. Convention on the Law of the Sea and the U.N Convention to Combat Desertification contain similar provisions.[122]

[119] Memorandum for Heads of Federal Departments and Agencies from Nancy Sutley, Chair, U.S. Council on Environmental Quality, "Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions" (Feb. 18, 2010), *available at* http://ceq.hss.doe.gov/nepa/regs/Consideration_of_Effects_of_GHG_Draft_NEPA_Guidance_FINAL_02182010.pdf.

[120] U.N. Framework Convention on Climate Change, art. 4(1)(f), *opened for signature* May 9, 1992, 1771 U.N.T.S. 165, 171 (entered into force Mar. 21, 1994).

[121] Convention on Biological Diversity, art. 14(1)(a), *opened for signature* June 5, 1992, 1760 U.N.T.S. 143, 151 (entered into force Dec. 29, 1993).

[122] U.N. Convention on the Law of the Sea, art. 206, *opened for signature* Dec. 10, 1982, 1833 U.N.T.S 397, 481 (entered into force Nov. 16, 1994); U.N. Convention to Combat Desertification in Those

- The *Paris Declaration on Aid Effectiveness* states that EIA should be used in "addressing implications of global environmental issues such as climate change, desertification and loss of biodiversity," and calls on donor agencies and partner countries to "develop and apply common approaches for 'strategic environmental assessment' at the sector and national levels."[123] **End box**

In order for EIAs prepared under these laws to include climate change impacts on the environment, the legal language must be broadly interpreted to allow for consideration of **exogenous** changes in the environment (i.e., those changes not brought about by the project itself or by other human activities in the region). Many countries' EIA laws are broad enough to include consideration of climate change, but this power may be underutilized or not well understood. Guidance documents from agencies charged with overseeing the implementation of an EIA law can direct those undertaking EIA to include climate change in their analysis, as the U.S. Council on Environmental Quality did in 2009.

The definition of the "environment" itself may determine whether the scope of an EIA analysis is broad enough to include climate change as a factor for consideration. Generally, most definitions in national laws are quite broad. The Nigerian EIA law, for example, defines "environment" as "the components of the Earth, and includes land, water and air, including all the layers of the atmosphere; all organic and inorganic matter and living organisms; and the interacting natural systems that include [the above] components."[124] An "environmental effect" means "any change the project may cause to the environment, whether such change occurs within or outside Nigeria, and includes any effect of any such change on health and socio-economic conditions."[125] This definition provides significant authority to consider the effects of climate change on projects for which an EIA is required. However, specific guidance on the consideration of climate change impacts will be important to ensure those preparing the EIA actually do consider climate change. The authority to do something is often very different from a willingness to actually do it.

At least four types of impacts frequently identified as requiring analysis in EIA laws can be used to categorize and consider different types of effects of climate change on most major projects that affect biodiversity or natural resources.

- **Indirect (or "secondary") impacts**
  - Example: Farmers increase their use of pesticides in agriculture to deal with increase in weeds, which has the secondary effect of increasing toxic farm runoff into nearby water bodies.

Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, art. 10(4), *opened for signature* Oct. 14, 1994, 1954 U.N.T.S. 108, 117 (entered into force Dec. 26, 1996).

[123] OECD, Paris Declaration on Aid Effectiveness arts. 40 & 41 (adopted Mar. 2, 2005), *available at* http://www.oecd.org/dataoecd/11/41/34428351.pdf.

[124] Nigeria, Decree No. 86 of 10 Dec. 1992, art. 63(1) (Supplement to Official Gazette Extraordinary No. 73 Vol. 79, 31st December 1992—Part A A979).

[125] *Id.* art. 63(1).

- **Long-term impacts**
  - Example: A dam is built to generate hydroelectric power eliminating a migratory route for fish. Twenty years later, climate change has altered the regional water cycle so much that there is no longer enough water in the reservoir to generate power and the dam is abandoned.
- **Cumulative impacts**
  - Example: Sea walls are built to protect cities along a country's coast from climate change. In the aggregate, this has the effect of severing a large percentage of the country's coastal habitats from inland habitats.
- **Irreversible impacts**
  - Example: A mine is opened and operated in high-elevation core habitat for a rare mountain species. Climate change has pushed that species up the mountain and out of lower-elevation areas. The mining activity renders the remaining habitat unsuitable and the species goes extinct.

Box. Opportunities to Consider Climate Change in Bhutan's EIA Law

Practitioners will need to closely examine EIA laws to identify opportunities to include and respond to the effects of climate change on major projects. For example, Annex 3 of Bhutan's Regulation for the Environmental Clearance of Projects of 2002 requires all Environmental Clearances (EC, Bhutan's term for EIA) to consider the "*potential* environmental, economical and social impacts of the proposal."[126] 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 the EC. Further, this law requires ECs to describe the "existing environment" in order to establish a baseline against which the project's impacts and mitigation measures can be assessed.[127] As discussed above, identifying 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 also provide adaptive capacity. 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."[128] The shear breadth of this language may be sufficient to incorporate relevant effects of climate change on project viability, cost, or impact within the EC analysis. However, 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 its provisions on mitigation measures. These provisions require an "implementation

[126] Regulation for the Environmental Clearance of Projects, annx. 3 (2002) (Bhutan) (emphasis added).
[127] *Id.* § 7.
[128] *Id.* § 8.

schedule that shall ensure that mitigation measures shall be implemented prior to or when appropriate in relation to environmental impacts."[129] This "schedule" introduces a temporal element into impact analysis and mitigation, possibly providing the implicit authority to recognize and mandate adjustments in response to a project's changing ecological context. **End Box**

[129] *Id.* § 9.

Chapter 8 Compliance and Enforcement: Mechanisms to Balance Flexibility with Accountability

Adaptive management done properly is *more* rigorous, involves heightened procedural requirements, and demands more follow-through, accountability, and enforcement than traditional management frameworks. Laws to guide adaptive management should be detailed and clearly written; they should impose mandatory requirements for implementation and compliance; and impose enforceable disincentives and other penalties when procedures are not followed.

There is nothing contradictory about developing adaptive management protocols and also imposing strict legal and procedural safeguards. However, the increased discretion required for adaptive management presents challenges to developing enforceable standards and regulations.[130] These may include:

- Local non-environmental interests may be in a better position to influence decentralized or discretionary management programs
- Risk of political deal making in the absence of clear, enforceable external standards, raising "rule of law" concerns that the laws will not be applied equally
- Courts may have difficulty adjudicating disputes involving "adjustable" substantive and procedural rules or open-ended timetables
- Regulated entities may not cooperate in imposing management burdens on themselves and may engage in "stonewalling, strategic bargaining, dilatory tactics, and other forms of unilaterally imposed transaction costs"[131]

These concerns will be most acute when adaptive management is attempted through unenforceable policies or management plans that lack the force of law. Where procedures and substantive rules for adaptive management are built into the law itself, are legally enforceable, and are subject to oversight, adaptive management programs can achieve more resilient outcomes for ecosystems and people. This chapter discusses the role of law in assuring accountability for management decisions within a flexible, adaptive management framework.

8.1 Setting and Enforcing Climate-resilient Management Objectives

Key point: Adaptive management helps identify and improve the best management strategies to reach ultimate objectives for a resource or ecosystem. The flexibility designed into adaptive management, however, should not carry over completely into the process for setting those ultimate objectives. Defining and modifying ultimate goals requires a different set of procedures that are more stringent than those governing adjustments in how those goals should be achieved.

---

[130] *See* Bruce Pardy, *The Pardy-Ruhl Dialogue on Ecosystem Management Part V: Discretion, Complex-Adaptive Problem Solving and the Rule of Law*, 25 PACE ENVTL. L. REV. 341 (2008)
[131] Bradley C. Karkkainen, *Adaptive Ecosystem Management and Regulatory Penalty Defaults: Toward A Bounded Pragmatism*, 87 MINN. L. REV. 943, 961-65 (2003).

This section provides several options for setting objectives for biodiversity in spite of the changes in ecosystems that will be caused by climate change. Adaptive legal frameworks may require a graduated system of checks-and-balances that intensifies for decisions that change ultimate goals rather than shift the methods of achieving them. To illustrate, if managers wish to restore a rare bird to 50% of its baseline population in a protected area within a given time period, it may be appropriate to use adaptive management techniques to determine the best management approach for achieving this target. But would it be appropriate for a regulatory framework to delegate to the managing official the power to adjust the target based on a scientific claim that the species cannot be restored to the target level due to a change in the local climate?

The problem is that external stresses like climate change affect ecosystems and biodiversity in ways that are outside the control of the local managing authority. While some flexibility to adjust targets is likely necessary given the broad impacts of climate change, decisions to change a substantive management or restoration goal are of a different order than decisions to adjust the methods by which a fixed goal is reached. Two possible approaches could provide some measure of accountability in determining, enforcing, and modifying conservation goals and benchmarks for a natural resource.

One approach is to incorporate the concept of **resilience** as a broad legal standard against which to review individual decisions affecting the ultimate status of an ecosystem. Rather than a rigid test, the question of what constitutes acceptable management policies to achieve resilient ecosystems might turn on the analysis and balancing of several different factors:

- The values and services provided by the resource in its prior state
- The values and services provided by the resource in its anticipated future state
- The uniqueness of the resource
- The cost of restoring the resource to its prior state.[132]

This approach recognizes that when dealing with potential climate change impacts, managers will need to make decisions about which species or ecosystem goods or services should be given priority protections. But it also provides a test against which those decisions can be evaluated. The test is flexible because it requires a case-by-case analysis, but it is enforceable because decisions can be evaluated to determine whether they have the effect of enhancing or weakening the resilience of the ecosystem. For example, decisions about whether to restore a degraded coastal wetland can be evaluated by an assessment of the future anticipated state of the wetlands given sea level rise, salinity intrusion, and other effects of climate change. The resilience test may then be applied to support a determination that resources should be invested in preparing areas farther inland to become new coastal wetlands rather than attempting to restore wetlands at the current coastline.

[132] Quotes and concepts adapted from Alyson C. Flournoy, *Protecting a Natural Resource Legacy While Promoting Resilience: Can it be Done?*, 87 NEB. L. REV. 1008, 1030-32 (2009).

A second approach is to set **thresholds** for indicators of ecological functionality that automatically trigger remedial or contingency actions when they are crossed. For example, thresholds might be set for:

- Population limits for migratory species or other keystone species below which the major ecological functions they serve are impaired
- Measures of ecosystem services such as water filtration, biodiversity levels, or storm-buffering capacity
- Losses of endemic species compared to non-native species as a percentage of total population numbers, biomass, or other suitable proxy in a defined area

The purpose of these types of thresholds is to automatically trigger regulatory actions. They reflect the fact that climate change may force changes in management strategy, but they also limit the discretion of managers to a pre-determined set of actions or new authorities. When they are designed to ensure ecological integrity and not just the bare survival of individual species, they have been called "thresholds of abundance."[133]

Adjustment of ultimate objectives or redefinition of thresholds should not happen without significant input by the public and stakeholders through a deliberative process in which the scientific and policy bases for the adjustment are laid out for debate and possible rebuttal. Though courts may not have competency to assess the scientific merits of this type of decision, they should be able to review the record to determine if public participation and scientific assessment procedures have been followed and the managing authority has rationally and thoroughly considered all the evidence before it.

8.2 Options for Insulating Flexibility Mechanisms from Misuse

Key Point: Policymakers can give on-the-ground managers and resource users flexibility without sacrificing environmental protections or procedural safeguards. Climate change calls for laws that meet biodiversity-sustaining benchmarks over the long-term with flexibility in the means used to meet the benchmarks.

Section 8.1 looked at ways of setting targets for resource management that are adaptable to climate change. This section looks at how best to maximize beneficial, on-the-ground flexibility within a framework of long-term goal setting and accountability. Mechanisms for flexibility are critical to adaptive management. Flexibility in the law, however, must be carefully defined. "Flexibility" does not mean managers and local stakeholders receive a blank check to go back on previously agreed commitments. Some examples of legal flexibility to support adaptive management without sacrificing accountability may include the following:

- Allowing managers to use their expert judgment to make policy adjustments on issues that have been decided from the start should be within the managers' discretion

[133] Robert L. Fischman & Jeffrey B. Hyman, *The Legal Challenge of Protecting Animal Migrations as Phenomena of Abundance*, 28 VA. ENVTL. L. J. 173, 189-205 (2010).

- Setting standards individually by region based on local conditions and climate impacts
- Limiting or suspending court review of decisions that require a high level of ecological or scientific expertise, yet allowing court review when agencies have been charged with violating substantive or procedural requirements in the law itself
- Giving powers to adjust terms and conditions of resource use permits and authorizations to reflect changing ecological conditions
- Using existing legal tools and doctrines such as
    - Guidance on appropriate use of "enforcement discretion" (the right of government to choose not to prosecute an individual)
    - Administrative waivers (an agreement to waive compliance with specific regulatory requirements in exchange for achieving the same or better result by a different means), or
    - Out-of-court settlements to drop criminal or civil charges for environmental violations in exchange for the violator's commitment to perform conservation actions that go beyond what is required by current law

This last category of options must be used cautiously, of course, to avoid undermining enforcement efforts. Despite that caveat, management officials may be able to find opportunities to work with private actors to achieve conservation results that are better than what could be done under the strict letter of the law. Because climate adaptation is not yet included in most regulatory requirements, these opportunities may be particularly of value for testing innovative adaptation measures.

Example: Vietnam's "Second National Strategy and Action Plan for Disaster Mitigation and Management in Vietnam – 2001-2020" provides an example of how flexibility can be incorporated into natural resource management by tailoring programs to local conditions.[134] Each region of the country is charged with carrying out activities to mitigate natural disasters, but the Plan allows each region to develop strategies that are sensitive to its geographical and ecological context. For example, in some coastal regions the Plan calls for strengthening dike systems, reforesting mangroves, and protecting forests. The Eastern Coast and Islands apply the approach "Proactiveness in disaster prevention, and adaptation for development," while the Mekong River Delta applies the approach "living with flooding."[135] The flexibility in this approach comes through the recognition that ecological and geographical contexts have different needs and requirements. Similarly, a "one-size-fits-all" approach will not be appropriate for all resource managers in a country to confront climate change impacts.

In order to ensure accountability, it is critical that institutions and programs are in place to provide general oversight of these tools for management flexibility and discretion and to provide protections from potential misuse or malfeasance.. These protective mechanisms may include:

[134] Vietnam, Prime Minister's Decision 172/2007/ND-CP (2007).
[135] National Strategy Decision 172/2007/ND-CP (2007).

- Judicial oversight to ensure agencies comply with basic regulatory or legal requirements (including judicial power to remand a case to the agency to make adjustments)
- Procedural rules that tie discretionary power to make adjustments in management to specific reference points or benchmarks based on high quality monitoring and data collection
- Third-party independent audits of management programs
- Internal control officers within agencies or ministries
- Administrative, civil, and criminal penalties for officials who violate regulatory safeguards, accept bribes, or engage in other forms of corruption
- Remedial training programs for neglectful or unskilled managers
- Capacity-building exercises, workshops, and seminars for officials

The discretion to adapt management strategies in response to climate change can be limited through many types of binding and enforceable "hard law" tools to ensure adaptive measures do not infringe basic rights, produce inequitable results, or provide a cover for corrupt or abusive practices.

Box. Clear Legal Drafting Is Essential for Adaptation Policies

Drafting and enacting precise legal language is difficult. But the risk of overly broad or vague laws and regulatory programs is that they are much more likely to be misused and fail their intended purpose. Laws related to adaptation efforts are no different. The following example comes from a legislative proposal to establish a mixed-use, public-private refuge in a coastal area to protect leatherback sea turtles in response to climate change and other human-caused impacts. While its aims may have been well-intentioned, several provisions in the bill were vaguely worded and created significant risks to the future of the management program.[136] Below are several of these "red flag," provisions and explanations of how imprecise or overly broad legislative language can create potentially troublesome outcomes:

"Direct collaboration between the public authorities and the private owners is intended …. [J]oint management, carrying due respect for current guidelines…"

Red Flag: "Joint management" can be an effective means of collaboration between private stakeholders and officials. But without a backstop of mandatory protections, this could give landowners or developers the power to veto government regulations that they do not like. Moreover, the phrase, "due respect for current guidelines," is so vague that it may neither adequately protect the turtles from exploitation nor property owners from capricious government actions.

[136] An English language version of the draft law can be found at http://www.leatherback.org/pages/LawProject17383/LawProject17383_071909.pdf (last visited Nov. 19, 2009).

"The [management plan] shall be developed jointly by [the ministry] and the association constituted exclusively by the owners of the land included in the limits established for the Refuge …"

Red Flag: Limiting the development of the plan to only the ministry and the property owners is too narrow. Left out of the development are interested stakeholders such as tour operators dependent on the turtles, environmentalists, scientists, and others in the community. Moreover, without a wider stakeholder input, the legislation puts a small group of local landowners in too great a position of control over the fate of a critically endangered, internationally protected species.

"[Lands] shall remain in the Refuge for equal and consecutive periods of ten years … these periods [will be renewed] automatically, as long as the public objective motivating the creation of this Refuge is maintained."

Red Flag: This clause allows for the dissolution of the Refuge after a ten year period. The renewal of the Refuge program is only automatic as long as a vaguely defined "public objective motivating the creation of this Refuge is maintained." This opens the door for Refuge opponents to argue that climate change has rendered the refuge unsuitable for turtles and therefore that the public objective is no longer valid. While periodic review of resource management and protection is essential for adaptive management, this provision sets an arbitrary date and imprecise renewal requirements that may make it possible for opponents to halt the program.

These examples demonstrate the importance of good legislative drafting. Close attention to exact language is needed to prevent flexibility and collaboration from undermining environmental protections and stakeholder rights and safeguards.

An endangered leatherback sea turtle tagged for tracking in California. Photo: NOAA. **End box.**

Chapter 9 Enforcement Rights and Duties: Substantive and Procedural Rights and the Role of Courts in Climate Adaptation

In addition to administrative frameworks for adaptive management, there are other legal authorities that can be used to increase the resilience of ecosystems to climate change. This chapter looks at the role of constitutional provisions guaranteeing substantive and procedural rights. It also examines how courts can facilitate adaptive, collaborative governance through judicial procedure and standards of review. The constitutional rights this chapter will analyze are:

- The substantive right to a clean and healthy environment
- The substantive right to private property
- The procedural rights of access to information and the courts

The constitutions of many countries provide a right to a healthy environment (or a right to life that is interpreted to include the right to live in a healthy environment) and guarantee rights to ownership or use of private property. They may also impose a duty upon government to protect the environment for its citizens. These rights or duties provide powerful legal tools to push governments to take measures to protect resources from climate change. *First*, they can be used defensively, or restrictively, to protect against government encroachment upon an enforceable right (e.g., halting government authorizations for a development project that threatens resources).[137] *Second*, they can be used affirmatively, or constructively, to compel government to take action to protect a right (e.g., stopping a private polluting enterprise from discharging into a protected area).[138] *Third*, and perhaps most importantly in the context of climate change and other emerging environmental stressors, a broad constitutional provision "can provide a 'safety net' for resolving environmental problems that existing legislative and regulatory frameworks do not address."[139] Other legal options for protecting ecosystems may be available as well, such as the public trust doctrine[140] or private causes of action for nuisance or trespass to stop activities that are maladaptive to climate change and cause damage to privately-owned lands, resources, or habitat.[141] (These topics will not be covered in this manual.)

9.1 The Right to a Clean and Healthy Environment

Key Point: In countries that recognize a constitutional right to a clean and healthy environment (or a constitutional "right to life" that is interpreted to include the right to live in a healthy environment), courts may have a stronger role in halting activities or behaviors that are maladaptive to climate change. Courts may even be able to mandate affirmative adaptation measures when government fails to act.

---

[137] UNITED NATIONS ENVIRONMENT PROGRAMME ET AL., CONSTITUTIONAL ENVIRONMENTAL LAW: GIVING FORCE TO FUNDAMENTAL PRINCIPLES IN AFRICA 1 (2d ed. 2007).
[138] *Id.*
[139] *Id.* at 2.
[140] *See* Robin Kundis Craig, *Adapting to Climate Change: The Potential Role of State Common-Law Public Trust Doctrines*, 34 Vt. L. Rev. 781 (2010).
[141] *See* Christine A. Klein, *The New Nuisance: An Antidote to Wetland Loss, Sprawl, and Global Warming*, 48 B.C. L. REV. 1155, 1225-29 (2007).

If the right to a "clean and healthy environment" is interpreted to include ecological "balance" or "stability," then courts may be able to require governments to take adaptation actions that build social or ecosystem resilience to climate change impacts. Practitioners will need to explore how their countries' constitutions define rights and duties related to the environment and whether these rights are enforceable in court.

Examples: The Namibian Constitution requires the government to take action for the "maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilization of living natural resources on a sustainable basis for the benefit of all Namibians, both present and future."[142] This provision, emphasizing "ecological processes," "sustainability," and "future" Namibians, provides several "hooks" on which to hang a legal claim to compel climate adaptation activities to build ecosystem resilience for the future. Statutory enforcement provisions are a key next step.

The three East African Community countries, Kenya, Tanzania, and Uganda, each recognize rights in the environment that are privately enforceable through court action.[143] Uganda's constitution is the most comprehensive and provides "The State shall protect important natural resources … on behalf of the people of Uganda."[144] Uganda's constitution also articulates national principles and policy objectives such as balancing the interests of present and future generations through sustainable development, developing clean energy policies, and ensuring preservation of biodiversity through parks and reserves. Each of these elements of Uganda's constitutional rights framework provides legal authority to spur adaptation policies.

Box. Constitutional Law and Climate Change in Ecuador

Few countries have constitutional provisions explicitly dealing with climate change, but in 2008 the people of Ecuador voted to adopt a new Constitution that contains detailed provisions related to environmental rights, biodiversity, and climate change. The 2008 Constitution recognizes the right of every Ecuadorian to live in an environment that is "healthy and ecologically balanced."[145] The protection of the environment, the conservation of ecosystems and biodiversity, and the integrity of the country's genetic heritage are considered of public interest.[146] Nature itself has a right to have its processes and integrity kept intact – "Pacha Mama [Nature] … is entitled to full respect in its existence and maintenance and regeneration of its vital cycles, structure, functions and evolutionary processes."[147] By highlighting the importance of ecological processes, these provisions may allow for adaptation and evolution in natural systems over time while providing legal authority to protect such processes from undue or preventable degradation.

---

[142] CONST. art. 95, ch. 11, §(*l*) (1978) (Namibia).
[143] Patricia Kameri-Mbote and Collins Odote, *Courts as Champions of Sustainable Development: Lessons from East Africa*, 10 SUSTAINABLE DEVELOPMENT L. & POL'Y 31, 32 (2009).
[144] CONST., directive XIII (1995) (Uganda).
[145] *See* CONST. art. 14 (2008) (Ecuador).
[146] *Id.*
[147] *Id.* art. 71.

Duties to Adapt

Ecuador's Constitutional provisions on environmental and natural resource planning provide explicit authority for climate change adaptation. The Constitution requires the government to protect forests and vulnerable populations, which provides the state authority to undertake adaptive measures for biodiversity conservation in response to climate change.[148] The state is also responsible for establishing a system to prevent and manage natural disasters and risks. Among the highest priorities for Ecuador, a coastal mountainous country, is the need to preserve soil and prevent erosion.[149]

Ecosystem Approach

In affected areas, the Constitution obligates the government to forest and reforest the land using native species and to lend support to farmers to prevent soil loss.[150] Further, the government must guarantee the conservation and management of water resources, guided by human *and ecosystem* needs.[151] Ecuador guards protected areas and guarantees the protection of biodiversity and ecosystems.[152] The government's responsibility over the country's biodiversity is informed by the principle of intergenerational justice, or the duty to consider past and future generations in actions it takes.[153]

Collaboration with Communities

The state is to regulate the conservation, management and use of fragile ecosystems, including cloud forests, mangroves, and marine areas.[154] However, the constitution also provides that the responsibility for such environmental management will be decentralized.[155] Ecuador guarantees the active and permanent participation by all persons, communities and groups in the planning, execution and control of actions that impact their environment.[156] The Constitution empowers natural and legal persons the right to protect nature and promote respect for ecosystems and grants any natural or legal person or group, without prejudice to the person's direct interest, *locus standi*, or standing to challenge, in environmental matters.[157]

Despite the strong wording of these provisions, it is too soon to know how they will be implemented, enforced, and interpreted. **END BOX**

Courts are able to apply these types of constitutional provisions in powerful ways. For example, in *Rural Litigation & Entitlement Kendra v. Uttar Pradesh*, the Indian Supreme

[148] *Id.* art. 414.
[149] *Id.* art. 409.
[150] *Id.* art. 410.
[151] *Id.* art. 411.
[152] *Id.* art. 397 (4).
[153] *Id.* art. 400.
[154] *Id.* art. 406.
[155] *Id.* art. 399.
[156] *Id.* art. 395 (3).
[157] *Id.* art. 71.

Court construed the right to a healthy environment to include an entitlement to "ecological balance" and ordered the cessation of an unauthorized mining operation despite lack of a direct impact on human health.[158] In the Hungarian *Protected Forests Case*, the Constitutional Court struck down a law as unconstitutional that would have redesignated protected areas as private lands for agricultural development, declaring that citizens have a right to the "highest possible level of physical and spiritual health."[159] Constitutional environmental rights cases often must decide between immediate economic interests (in this case, new agricultural lands) and long-term ecological health (protected forests or the environment independent of its utility to humans). Because constitutional rights extend theoretically to perpetuity, they are powerful tools to force consideration of long term climate impacts to a country's natural resources and, at least within some legal systems, to require the consideration of those impacts even when pitted against the prospect of immediate human economic gain.

The public trust doctrine similarly emphasizes the obligation of the government to maintain publicly owned resources for future generations. This may be an effective doctrine to drive climate adaptive resource laws and policies.[160] (For more on the role of the public trust doctrine for adaptation on private lands, see section 13.4.)

In some countries, constitutional rights to a healthy environment have a "horizontal" operation, imposing legal duties on private actors.[161] For example, Bhutan recognizes a constitutional right to a healthy environment that provides, "Every Bhutanese is a trustee of the Kingdom's natural resources and environment for the benefit of the present and future generations and it is the fundamental duty of every citizen to contribute to the protection of the natural environment.…"[162] Further, the Royal Government "shall protect, conserve and improve the pristine environment and safeguard the biodiversity of the country" as well as "[s]ecure ecologically balanced sustainable development while promoting justifiable economic and social development."[163] The emphasis on "trusteeship" and duties in Bhutan's constitution suggests that private persons and entities should account for climate change in their activities that may affect other people.

Such provisions might be used to stop private economic development projects that are maladaptive to climate change even if the government is not directly involved. The Supreme Court of Chile in *Pedro Flores v. Corporación del Cobre, Codelco, Division Salvador* enjoined a mining company from further deposition of copper tailings onto beaches after it was shown the practice was causing a massive die-off of marine life. The

---

[158] A.I.R. 1985 S.C. 652, 656; A.I.R. 1988 S.C. 2187 (S. Ct.) (India).
[159] Magyar Közlöny Case No. 1994/No.55, p. 1919 (Hungarian Constitutional Court, 1994).
[160] *See* M.C. Mehta v. Kamal Nath et al., 1 S. Ct. 388, ¶ 32 (writ petition before the Supreme Court of India Dec. 13, 1996) ("Thus, the public trust is more than an affirmation of State power to use public property for public purposes. It is an affirmation of the duty of the State to protect the people's common heritage of streams, lakes, marshlands and tidelands ….") (quoting Nat'l Audobon Soc'y v. Superior Court of Alpine County, 33 Cal. 3d 419, 441 (Cal. 1983) (U.S.A.)).
[161] United Nations Environment Programme et al., Constitutional Environmental Law: Giving Force to Fundamental Principles in Africa 29 (2d ed. 2007).
[162] Const. art. 5(1) (2008) (Bhutan).
[163] *Id.* art. 5(2)(a)&(c).

court relied on Articles 19 (right to live in unpolluted environment) and 20 (authorizing actions to enforce Article 19) of the Chilean Constitution for authority.[164] The mining company was a private actor, but the court used constitutional guarantees to a healthy environment to halt actions that were clearly harmful. A similar logic may be used to stop private actions that will increase the vulnerability of natural resources to climate change in the long-term (e.g., logging on a timber concession that exposes a downstream community to risks of landslides in the event of extreme weather events).

9.2 Private Property Rights: Opportunities and Obstacles for Adaptation

Key Point: Private property rights must be respected and need not pose an obstacle to adaptation measures. They may provide an incentive for adaptive measures if owners sense they have a long-term stake in the well-being of their land. However, reasonable public measures to conserve biodiversity on private lands are important for adaptation and do not necessarily constitute an unconstitutional taking of private property.

Private property rights present both opportunities and challenges in implementing adaptation policies for natural resources. Expropriation of property can be so costly as to preclude use of private property areas to accomplish conservation aims. This problem is significant in an era of climate change in which the shifting ranges and habitats of many organisms will bring them onto private lands where conservation measures traditionally have been very weak.[165] Rights to property may pose an obstacle to more innovative or far reaching conservation measures necessary to protect resources from climate change. However, private lands conservation through collaboration with landowners is a potent method of extending sound management of resources for climate change beyond public lands.[166] (See Chapter 13 on adaptation in private lands conservation.)

Practitioners must look at the body of law on property issues within their own countries to determine whether constitutionally protected private property rights will pose an obstacle to climate change adaptation actions. One recent Ugandan case provides support for the view that decisive action to protect ecosystems on private lands does not necessarily rise to the level of an unconstitutional "taking" of that property. In *Nyakana v. NEMA*, the Constitutional Court of Uganda dismissed a petition on behalf of a landowner who alleged his property had been taken unconstitutionally when the National Environmental Management Authority (NEMA) demolished a house he was constructing within wetlands after he failed to obey a restoration order.[167] The petition relied in part on Article 26 of Uganda's Constitution, which forbids compulsory deprivation of property except (1) in service of public purposes and (2) under a law providing for fair compensation and an opportunity to be heard. The court found authority for the agency's actions under Uganda's National Environment Management Act, which restricts any use

[164] ROL.12.753FS.641 (Supreme Court of Chile, 1988).
[165] Kathy J. Willis and Shonil A. Bhagwat, *Biodiversity and Climate Change*, 326 SCI. MAG. 806, 807 (2009).
[166] *See* ENVTL. L. INST., LEGAL TOOLS AND INCENTIVES FOR PRIVATE LANDS CONSERVATION IN LATIN AMERICA: BUILDING MODELS FOR SUCCESS (2003).
[167] Const. Pet. No. 03/05 (Const. Ct. of Uganda Nov. 9, 2009).

of wetlands without prior approval of the agency. The court agreed with the reasoning of the respondents that "[w]hat was taken away from him was misuse of the land and this was done to protect the environment."[168] A concurring judge noted, "[S]uch wetlands could not be granted to private individuals/entities because the State holds such natural resources in trust for the citizenry and they must be preserved for the public benefit ….[169]

This ruling provides important precedent in Uganda that private property rights do not trump constitutional and legislative mandates to protect the environment. This will provide Uganda's NEMA with more flexibility to confront environmental challenges arising from climate change impacts. The determination that a particular private land use threatens ecological values held in trust for the public may be found sufficient to justify governmental restrictions on those private actions without expropriation or compensation.


Dambo wetlands in Uganda.[170]

Private property rights need not be in tension with strong environmental governance. Indeed, sophisticated use of private rights can be used to motivate private actors' engagement in management programs. For example, Project Elé, an effort sponsored by the Argentinean government to save the blue-fronted parrot while maintaining a healthy export market, achieved meaningful private engagement by limiting the right to collect the bird to local landowners contingent on their participation in the management plan.[171]

9.3 Procedural Rights: Access to Information, Public Participation, and Citizen Enforcement Power

Key Point: The rights to obtain information about and to participate in resource decision making are essential for climate adaptation planning. Informed participation by civil society actors such as non-governmental organizations, businesses, and academic institutions can help facilitate a holistic, cross-sector, multi-stakeholder, ecosystem-level thinking about resource management.

---

[168] *Id.* at 14.
[169] *Id.* at 14 (Byamugisha, J., concurring).
[170] Dambo Wetlands Research Project, http://www.geog.utah.edu/dambo/index.html (last visited July 16, 2010).
[171] Jorge Rabinovich, *Parrots, Precaution, and Project Elé: Management in the Face of Multiple Uncertainties*, *in* BIODIVERSITY AND THE PRECAUTIONARY PRINCIPLE 177, 184 (Barney Dickson and Rosie Cooney eds. 2005).

Civil society actors generally work with many different government bodies, private sector actors, funding institutions, and local community groups, and their activities encompass both science and policy. These groups can play an important coordinating and connecting role in carrying out complex climate adaptive strategies.[172] These organizations, and others with interests in adaptive resource management such as businesses and local communities, can be given institutionalized legitimacy through laws that encourage a strong role in adaptive governance.[173] The ability of these groups to act in this role, however, is dependent upon the strength of a country's laws allowing the public to obtain access to government information, participate in development decisions, and enforce legal requirements when the government fails to act.

There are a number of legal instruments or methods that can confer upon these groups legal status that will enhance their ability to participate in climate change adaptation. Some examples include:

- Constitutional or statutory rights to obtain information held by the government (e.g., Liberia's Environmental Protection and Management Law §105 (2002) provides for freedom of access to information regarding the "development and management of the environment and natural resources;" in the United States, the Freedom of Information Act (FOIA) allows individuals to request and obtain information held by government agencies.)
- Constitutional or statutory rights to go to court on behalf of environmental interests and protections
- Consultation requirements with respect to the development of new legislation
- Statutory rights to participate in planning, management, and regulatory decisions (Liberia's Environmental Protection and Management Law (2002) §§11 - 21 requires a "scoping process" that ensures public participation in environmental impact assessments and requires the agency to disseminate the proposed environmental impact statement to and invite comment from those most likely affected by the project. In addition, under Section 20, at least one person based in or living within the area affected by the proposed project must be included on the EIA committee reviewing the EIS.)
- Autonomous rights to control resources in decentralized or federal systems or on indigenous or native lands[174]

Examples: In general, most countries' laws require or allow public participation, but enforcement of those provisions is not fully guaranteed through use of administrative appeals, judicial power to set aside unlawful action, or other compliance mechanisms. In the Dominican Republic, the environmental ministry is encouraged but not mandated to

[172] Cassandra Brooke, *Conservation and Adaptation to Climate Change*, 22 CONSERVATION BIO. 1471 (2008).
[173] Harry Blair, *Participation and Accountability at the Periphery: Democratic Local Governance in Six Countries*, 28 WORLD DEVELOPMENT 21 (2000).
[174] Significant information about public access and tools to improve the ability of stakeholders to influence government decisionmaking may be found at www.accessinitiative.org.

include civil society and community organizations in environmental plans, programs, and projects.[175] The requirement is vaguely worded and there is no established penalty for exclusion of the groups from decision making. In Vietnam, the strategic environmental assessment law provides: "Organizations and individuals shall have the rights to submit their requests and recommendations of environmental protection to the agencies that are responsible for establishing the review councils, and the … [councils] shall have responsibility to consider these requests and recommendations prior to their conclusions and decisions made."[176] However, like the Dominican Republic law above, this law does not clearly specify the consequences of failure to follow the mandate. The lack of defined remedies for violations can weaken or even eliminate meaningful public participation

9.4 Problems with Standing to Bring Climate Change Court Cases

Key Point: Courts can play a stronger role driving climate adaptation policies in jurisdictions that provide civil society actors broad access to courts through doctrines of "standing" and "legal interests."

In additional to participation in adaptation programs at the administrative level, citizens groups and civil society have an oversight and enforcement role to play through the use of the court system. An independent judiciary with power to hear complaints brought by private groups, businesses, or citizens can review resource management decisions that may be maladaptive to climate change. In order to obtain this review, however, such groups must have standing, or the right to be heard in court.

The doctrine of *locus standi*, or standing, generally provides that only parties with real grievances that can be redressed through adjudication should have their cases heard in court. In many cases, climate impacts may be difficult to quantify, located in the future, or suffered by a great many people but no one in particular worse than any other. Nonetheless, if the concerns of communities or organizations about climate change that prompted the suit are valid, and the legal footing of the suit is otherwise sound, then the doctrine of standing should not be used to block a potentially powerful judicial role.

Examples: As articulated in an important Bangladeshi case, that country's doctrine of standing provides, "If [the citizen-applicant or the indigenous and native association] espouses a public cause involving public wrong or public injury, he need not be personally affected. The public wrong or injury is very much a primary concern of the Supreme Court which in the scheme of our Constitution is a constitutional vehicle for exercising the judicial power of the people."[177] This doctrine is likely broad enough for a wide range of citizen suit actions.

In the United States, a more narrow interpretation of standing requires persons bringing a lawsuit, the plaintiffs, to show, among other things, an injury that is concrete and

[175] Dom. Rep. Gen. Law on the Environment 64-00 §18(11).
[176] Vietnam Law on Environment Protection art. 17(5) (2005).
[177] Dr. Mohiuddin Farooque v. Bangladesh et al., Civil Appeal No. 24 of 1995, 17 B.L.D. (AD) 1997, vol. XVII, pp. 1-33, 1 BLC (AD) (1996) pp. 189-219 (High Court of Bangladesh).

particularized and actual or imminent, not conjectural or hypothetical. This high bar to meet the standing requirement has forced many groups to spend extra time and money to establish the right to be in court to pursue legal claims related to climate change.[178] The U.S. House of Representatives attempted to strengthen the basis for legal standing due to climate injury through legislative findings in the American Clean Energy and Security Act of 2009. The bill, which has not been passed into law, states,

> That many of these effects and risks of future effects of global warming are widely shared does not minimize the adverse effects individual persons have suffered, will suffer, and are at risk of suffering because of global warming. That some of the adverse and potentially catastrophic effects of global warming are at risk of occurring and not a certainty does not negate the harm persons suffer from actions that increase the likelihood, extent, and severity of such future impacts.[179]

These legislative findings emphasize that climate change causes injury; that an increase in the risk of injury is itself a form of injury; and that injury to many people is not "injury to none." In the U.S. legal system, language such as this that is inserted into climate change legislation can influence a court's analysis of whether a party has legal standing to be in court in cases related to climate change.

9.5 Using Courts to Foster Adaptive and Collaborative Resource Management

Key Point: Though it may be beyond the power or expertise of a court to adjudicate complicated scientific disputes, it is within a court's powers to determine whether procedural requirements, including those procedures for effective adaptive management, are being met.

Adaptive management poses special problems for courts that have power to review agency decisions on climate change. Agency decisions related to large scale, long-term ecosystem management made under conditions of scientific uncertainty are difficult for courts to effectively review. Officials and managers implementing long-term adaptive management frameworks require broad discretion to review and adjust strategies without a constant threat of litigation. But this discretion makes it difficult to determine whether adaptive management is achieving long-term conservation targets. One way to provide some oversight over these discretionary decisions is to ensure that they are adequately supported by the scientific data and available information.

One approach is for NGOs, businesses, and other non-government entities with an interest in improved sustainable management of resources to target litigation effort

[178] *See* Center for Biological Diversity v. Department of the Interior, 563 F.3d 466 (D.C. Cir. 2009) (USA) (finding only limited standing to pursue "procedural injury" claims and no standing to pursue substantive claims related to climate change because petitioners could only show their climate injury "may" occur and was not "actual or imminent").
[179] H.R. 2454, 111th Cong. § 311 (proposed Clean Air Act § 701(a)(4)-(5) (2009) (U.S.A.)).

toward an improved learning function within resource agencies.[180] The questions that could be useful to bring before the court to answer might include:

- Is the agency using or ignoring data collected through monitoring efforts?
- Has the agency complied with periodic review schedules?
- Has the agency considered and addressed all relevant concerns of stakeholders, including scientific experts?

Examples: Australia's state level courts have heard four cases involving questions of climate adaptation in relation to coastal development. In each case, the future, long-term impacts of climate change were determined to be relevant to regulatory decisions and judicially cognizable in evaluating the validity of the regulatory determination.[181]

- **Aldous v. Greater Taree City Council**:[182] The requirement to consider ecologically sustainable land development includes a requirement to consider coastal erosion caused by climate change.
- **Gippsland Coastal Board v. South Gippsland Shire Council**[183]: The court applied the precautionary principle to determine that climate change created a foreseeable risk that a residential development site would be inundated and overturned the municipal permit.
- **Northcape Properties v. District Council of Yorke Peninsula**[184]: The court held that a city's refusal to allow development of coastal area was justified on the basis of sea level rise over the next 100 years.
- **Charles & Howard Pty Ltd v. Redland Shire Council**[185]: The court upheld an order to move a proposed dwelling to an area less vulnerable to tidal inundation from climate change.

Coastal development is at risk from sea level rise in Australia. Photo: NCCARF.

Box. Tailoring Courtroom Rules to Community Needs in Kenya

[180] *See* Holly Doremus, *Precaution, Science, and Learning While Doing in Natural Resource Management*, 82 WASH. L. REV. 547, 573-79 (2007) (comparing *Ecology Ctr. v. Austin*, 430 F.3d 1057 (9th Cir. 2005) (U.S.A.) and *Sierra Club v. Marita*, 46 F.3d 606 (7th Cir. 1995) (U.S.A.)).
[181] Case examples taken from Columbia Law School, Center for Climate Change Law, Michael B. Gerrard & Jerry Chen, Non-U.S. Climate Change Litigation Chart (last updated May 10, 2010), *available at* http://www.law.columbia.edu/null/download?&exclusive=filemgr.download&file_id=163021.
[182] [2009] NCWELC 17 (Land and Envt. Ct. of New South Wales 2009) (Aust.).
[183] [2008] VCAT 1545 (Victorian Civil and Administrative Tribunal 2008) (Aust.).
[184] [2008] SASC 57 (South Aust. Supreme Ct.) (Aust.).
[185] [2007] QCA 200 (Queensland Planning and Envt. Court) (Aust.).

Court procedures can contribute to a collaborative learning culture in resource management. The National Environmental Tribunal in Kenya was established to provide appellate review of licensing decisions by the National Environmental Management Authority. The Tribunal regularly hears cases related to EIA licensing, which under Kenyan law has strong public participation requirements. Members of the community are often called upon to provide testimony in these cases.

In traditional courtroom proceedings, rules for witnesses might require that they be absent from the courtroom for other testimony to prevent the chance for collusive lying between witnesses. But the Tribunal has not adhered to such strict evidentiary requirements because its members want to ensure that members of the community affected by a project under review have access to information that is presented in the proceedings. Community participants are encouraged to remain in the courtroom throughout the hearing even though they may serve as witnesses so that they have an opportunity to learn about the larger issues in the case. The Tribunal decided that it is more important to foster a learning environment around an environmental controversy, and that it could rely on other safeguards to determine if a witness was trustworthy. This is one simple way courts can foster learning among the community within the environmental regulatory process.[186] **End Box**

[186] Adapted from Jane Dwasi, Judge, Kenyan Nat'l Envtl. Tribunal, Presentation to the Environmental Law Institute., Kenya's Experience with Environmental Impact Assessment as a Tool for Sustainable Development: Opportunities and Challenges (Nov. 10, 2009).

Part 3: Implementing Adaptive Rules and Policies in Four Areas of Natural Resource Management

Part 2 analyzed broad design principles for biodiversity management programs and other high level legal provisions for adaptation to climate change. Legal frameworks contain many more elements: implementing regulations, management plans, permits, leases, customary practices and rules of conduct, private property relations, contracts, memoranda of understanding, etc. In each of these applications of the law, climate change may arise as an important consideration, and the statutory law governing the resource in question may not provide a clear method to resolve the concern. Part 3, like Part 2, will use principles of adaptive, ecosystem-based management to develop options that can be applied to help stakeholders and communities develop and implement adaptive rules and policies. However, unlike part 2, this Part explores mechanisms for adaptation in several specific contexts of resource use or protection.

This Part looks at four natural resource arenas where the methods of adaptive management can be directly applied to respond to climate change.

- Permitting, licensing, and concessions for natural resource access and extraction
- Community based natural resource management
- Protected areas on public lands and waters
- Private lands conservation

This Part is intended to operate on two levels: First, it provides guidance to legal and regulatory actors seeking to adapt to climate change in the absence of clear statutory programs or other high level mandates. Second, for those who are designing higher level legislation and policy for climate adaptation, this Part can be used to flesh out important on-the-ground considerations that will help inform national and international level legal and policy development.

Chapter 10 Permitting, Licensing, and Concessions for Natural Resource Access and Extraction

In many countries, the current permitting practices and laws governing the access and extraction rights for natural resources may hinder the capacity to adapt to potential climate change impacts.. This chapter provides options for improving them. Viewing permits as adaptive management tools fosters opportunities to monitor, assess, and modify management programs for the protection of resources that are affected by climate change.

For example, the use of leases to allow international agribusiness firms long-term access to fertile crop land is a growing practice in some developing countries. Though potentially beneficial for food security, governments often sign these contracts for very long periods, between 40 and 99 years. The leases contain few environmental requirements or conditions. They may lack clear means or standards for auditing, reviewing, adjusting, or cancelling the lease.[187] Thus if an area becomes less suitable to crop agriculture as the region becomes drier, the permit holder may continue to demand irrigation water as a right, even though this leaves less water for other uses. This chapter looks at how leasing and licensing practices for commercial scale access and extraction of natural resources can be made more adaptive to the effects of climate change.

[187] *See* Stephanie McCrummen, *The Ultimate Crop Rotation*, WASH. POST, Nov. 23, 2009, at A1.

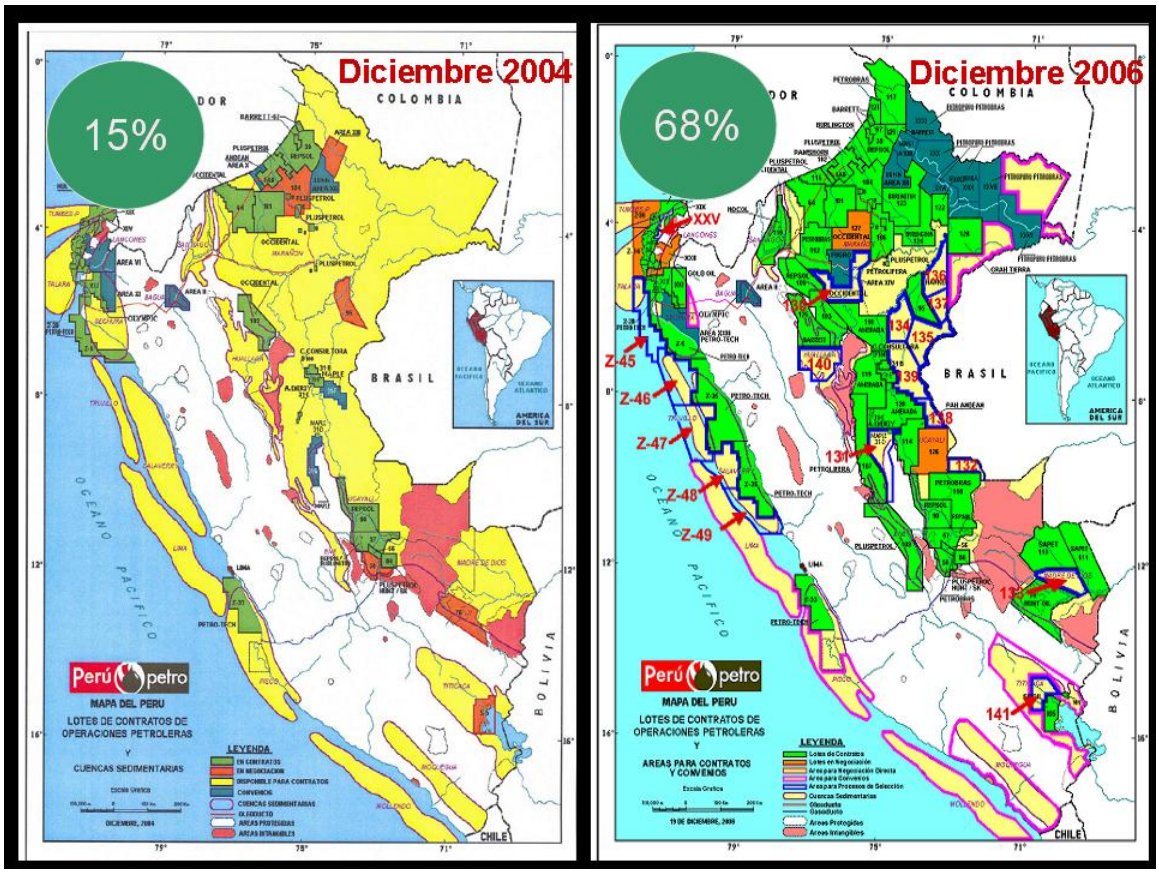


Figure X. Expansion of oil and gas leasing over two years in Peru. Although petroleum is not itself a resource contributing to the biodiversity of the environment, laws governing where, when, and how it may be extracted have enormous impacts on the surrounding ecosystems and communities.

10.1 Establishing the Legal Entitlement: A privilege or a right?

Key point: Permitting systems that give the resource user a legal entitlement that can be modified or terminated based on periodic assessments of ecological conditions, including the degree to which a resource is affected by climate change, are better able to adapt to climate change impacts.

Those with significant economic interests in a permit or concession understandably need some predictability and certainty in knowing what they can and cannot do with respect to target resources. Adaptive management can weaken that certainty. On the other hand, officials must also possess continuing authority to modify the terms of permits in response to changing conditions. Thus, a balance must be struck between providing clear terms and conditions for the permit holder and providing flexibility to allow the government to require modifications to adapt to changing circumstances. Brazil's permitting regime, for example, enables government officials to auction off timber rights within some sections of their rainforest, but the winners of such bids have neither title to

the land, nor the right to extract any resource other than timber.[188] The degree of legal entitlement authorized might depend on whether the permitting government views resource use as a **right** or a **privilege**. In general, a right gives the resource user an absolute interest. A privilege gives a resource user a conditioned interest. Conditional interests are generally more adaptable than absolute interests.

10.2 Authority to Evaluate and Adjust Permits: Reopener Clauses

Key point: Policymakers can improve permit evaluations by setting out specific procedural and substantive requirements governing when and how a permit can be "reopened" or modified. Permitting regulations can provide a procedural framework detailing who conducts project evaluations and at what intervals.

Climate change may have such a severe impact in an area that a permit issuing authority may need to suspend or modify previously issued permits in order to reevaluate impacts or halt further degradation. This authority can be written into the permit itself or in the regulations governing the permit. There are two ways in which the authority to reevaluate the permit can be invoked:

- **Triggering event**: an occurrence that directs the permit holders or government officials to respond in a prescribed manner
- **Temporal restriction**: a particular date or the passage of a specified time period that prompts a prearranged response

These provisions are called **reopener clauses**. Reopener clauses do not terminate a permit, but rather provide periodic opportunities for study and reconsideration of the permitted activity's impact on the environment given changing circumstances. Both triggering events and prescribed time schedules can be used in a reopener clause so long as the mechanism's ultimate function is to encourage evaluation, review, and adjustment throughout the permit's lifetime. For major development projects with significant economic benefits, it may not be realistic to expect officials to halt a previously authorized activity outright. In this circumstance, changing conditions might trigger a reopener on mitigation measures rather than changing the permitted activity itself. For example, the permit holder might be required to identify and set aside a greater amount of reserve land in proportion to the size of an unexpected ecological impact that occurs or is observed after a project is approved. Or the government might be required to remove land it was considering for future leasing from the leasing pool.

Determining the appropriate length of time between evaluations depends on the type of resource being used, the rate of use or extraction, regional impacts of climate change, and the overall objectives of the resource management program.

Examples:

[188] Larry Rohter, *Brazil Gambles on Monitoring of Amazon Loggers*, N.Y. TIMES, Jan. 14, 2007, at A11.

- Ecuador employs a time-based reopener clause in its permitting regime for petroleum extraction by private industries.[189] Companies may obtain a twenty-four year concession for oil extraction, which only may be renewed upon a determination that the permitted activity continues to be in the "public interest."[190]
- Madagascar grants forty-year mining permits, but the permit holder must undergo a mid-point evaluation and consent to revisions and modifications to the permit.[191]
- Uganda's 2003 mining law requires those holding exploration licenses and mining licenses to carry out an annual environmental audit.[192]

10.3 Flexibility to Allow Permit holders to Adapt to Climate Change

Key point: Permits that allow policies to change as ecological conditions necessitate ensure that climate stressed human populations will not suffer unnecessarily in situations where greater access to a resource or access to a new resource is warranted. However, such flexibility should not be allowed to undermine basic protections for biodiversity.

A permitting program that is too strict can jeopardize resource users' livelihoods in the face of radically altered or diminished resources or lead people to ignore the rules. Flexible permitting provides adaptive capacity to resource users by allowing shifts in use to the least vulnerable resources or migration to more fertile areas. For example, assume that a rural community resides near a protected area with a large lake located inside of it. The herders depend for water on a smaller lake located outside the park's boundaries. Climate-induced drought in the region dries up the smaller lake, forcing the herders to go in search of a new water supply. This situation poses a number of hard questions:

- Should the herders be allowed access to the lake inside the protected area?
- Can access be provided on a limited basis without opening up demands for more permanent access rights?
- Can conditions be imposed on the herders so that damage to the protected area is minimized?

These problems might be addressable through a flexible system of temporary permits. A temporary permit might provide:

> If the permit holder can demonstrate that the resource is substantially impaired as a result of changes in ecological conditions beyond the permit holder's power to control, including but not limited to those resulting from global climate change, the permit holder shall be allowed access to [a

[189] Kristen Hite, *Back to the Basics: Improved Property Rights Can Help Save Ecuador's Rainforests*, 16 GEO. INT'L ENVTL. L. REV. 763, 781 (2004).
[190] *Id.*
[191] Kai Batla (Pty) Ltd., http://www.kaibatla.co.za/madagascar.htm (last visited Sept. 11, 2009); *see also* Decree Nº 7802/2000 of 24 July 2000 in accordance with Act 99-022 (Aug. 19, 1999) of the Mining Act and Decree No. 2000-170 of Mar. 15, 2000 (authorizing a permitting scheme in which periodic evaluations are encouraged to foster improved resource management strategies).
[192] Uganda Mining Act § 108(3) (2003).

> resource] of comparable value on a limited basis and conditioned on appropriate mitigation measures.

A concern with this approach is the possibility that resource users will seek to maximize their use of temporary permits, thus making what should be an exceptional circumstance into a routine occurrence and putting undue stress on the ecosystem. Policymakers must evaluate the needs of resource users and ecosystems, as well as governance capacities, before implementing this type of permitting regime in order to strike a workable balance between conservation and the protection of human livelihoods.

Example: In Bolivia, the management and administration of protected areas has an objective of "ensuring effective participation and ownership of regional and local population" and "developing capacity in the local and regional level" to advance the management and conservation of such lands.[193] Bolivia's framework law mandates the involvement of public and private entities, including indigenous groups, in the management of protected areas.[194] These goals are demonstrated by the inclusion of local community and local governmental involvement in virtually all aspects of the Protected Areas Regulation. In exceptional cases, the National Government may issue a Supreme Decree to permit the use of natural resources within a protected area for a "national interest." However, any such activity must comply with other requirements in environmental legislation and regulations, including the completion of a monitoring plan and mitigation actions. If the permitted use threatens the conservation objectives of a protected area, it can only be authorized through a National Act.[195] These rules can be used to provide relief to climate stressed communities without sacrificing core conservation objectives in protected areas.

Box: Managing Climate Impacts on Forests and Logging Practices in Madagascar
Due to decades of deforestation, Madagascar retains only 15% of its original forests.[196] With the exception of slash and burn practices (or *tavy*), the country's most significant cause of deforestation is the harvesting of commercially valuable trees, such as rosewoods, palissanders, and ebonies.[197] In recent years, Madagascar has experienced an increase in floods, cyclones, and severe droughts—events likely to become more frequent and more intense as a result of climate change.[198] An increase in cyclone activity may enable loggers to exploit a provision in the forestry law authorizing salvage timber operations.

---

[193] Supreme Decree No. 24,781, art. 3.3-5 (1997) (Bolivia).
[194] Environmental Law No. 1333 art. 62 (1992) (Bolivia).
[195] Supreme Decree No. 24,781, art. 33 (Bolivia).
[196] *Harnessing Nature as a Solution to Climate Change in Madagascar*, Conservation International (Dec. 2008) (on file with author).
[197] Derek Schuurman & Porter P. Lowry II, *The Madagascar Rosewood Massacre*, 4 MADAGASCAR CONSERVATION & DEV. 98, 99 (2009).
[198] *Harnessing Nature as a Solution to Climate Change in Madagascar*, *supra* note 2.

The Malagasy government legalized the export of lumber felled during natural disasters in 2004 and expanded the scope of this activity in September 2009.[199] Scientists have demonstrated that "downed and damaged trees play an important role in forest recovery and ecosystem resilience."[200] Policies that allow removal of felled timber may lead to an "eliminat[ion] of leaf and woody biomass, decrease [in] evapotransporation…and damage[to] many soil and organic structures created by disturbance."[201] Beyond the ecological concerns of extracting downed timber, however, after Cyclone Gafilo hit in 2004, loggers were alleged to have gathered illegally extracted commercially valuable tree species that were still standing.[202]

Madagascar's case demonstrates that lifting the export bans in the aftermath of natural disasters can open forests to overexploitation.[203] A projected increase in the number of high intensity cyclones from climate change suggests this trend will continue.[204] There needs to be close monitoring of salvage timber operations. Permits authorizing some level of salvage logging may be appropriate, but they should not be a cover for practices that increase the forest ecosystem's vulnerability to climate change. **End box**

10.4 Including Stakeholder Input in Permitting Processes

Key Point: The list of stakeholders with interests in a resource is much broader than the group of people who own or directly use it. Including all relevant individuals, organizations, and entities in resource planning and management improves learning, coordination, and management outcomes. This builds adaptive capacity for climate change by creating a broader set of perspectives on all issues pertaining to the resource.

Increased stakeholder participation in resource governance improves the capacity of the system to adapt and respond to climate change. Identifying all stakeholders is not always easy and requires some investigation, but with biodiversity adaptation they may include:

- Community members
- Environmental organizations
- Resource extraction companies
- Local or indigenous resource users
- Scientific researchers and organizations

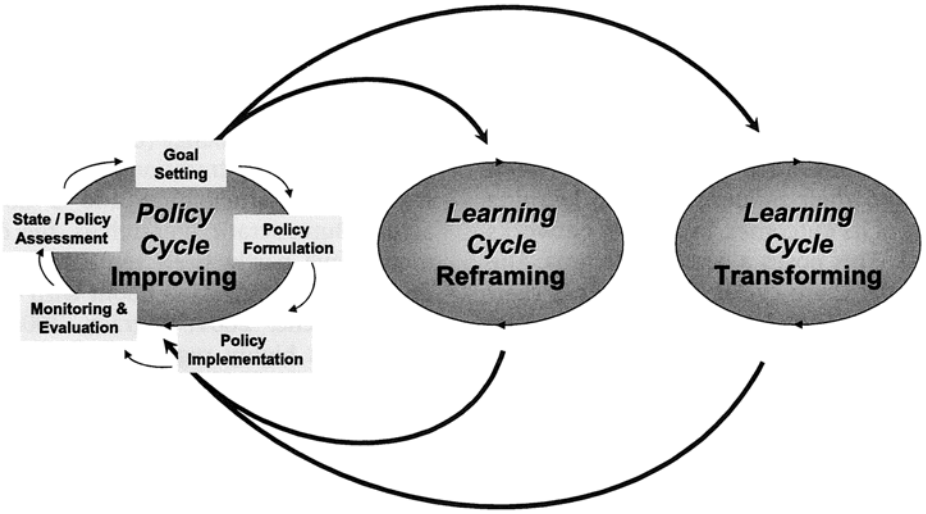
---

[199] Rowan Moore Gerety, *Major International Banks, Shipping Companies and Consumers Play Key Role in Madagascar's Logging Crisis*, Wild Madagascar, http://news.mongabay.com/2009/1215-rowan_madagascar.html (Dec. 16, 2009).
[200] Sarah Cooper-Ellis, David R. Foster, Gary Carlton, and Ann Lezberg, *Forest Response to Catastrophic Wind: Results for an Experimental Hurricane*, 80 ECOLOGY 2683, 2693 (1999).
[201] *Id*.
[202] GLOBAL WITNESS & ENVIRONMENTAL INVESTIGATION AGENCY, INC., INVESTIGATION INTO THE ILLEGAL FELLING, TRANSPORT AND EXPORT OF PRECIOUS WOOD IN SAVA REGION MADAGASCAR 5 (Aug. 2009).
[203] Rowan Moore Gerety, *Major International Banks, Shipping Companies and Consumers Play Key Role in Madagascar's Logging Crisis*, WILD MADAGASCAR, http://news.mongabay.com/2009/1215-rowan_madagascar.html (Dec. 16, 2009).
[204] *See* F. Busson, M. Andriamiarinosy, F. Monteils, and M. Randrianarison, *REDD à Madagascar : état des lieux et expériences en cours*, GREEN SYNERGIE 12 (2009).

- Tourism operators
- Religious organizations
- Officials from other agencies or government levels
- International organizations and other civil society institutions
- Trade organizations

Project designers might consider creating a **stakeholder group** and allow them, with appropriate oversight and accountability mechanisms, a significant role in the management of an ecosystem. This group would then be able to set conservation and use goals, develop a plan for implementation, and enforce rules. While care must be taken that minimum environmental protections are not lost, trust in the integrity of the process is essential for collaboration to work. Co-management efforts in Trinidad and Tobago, for example, were undermined as the local coral reef users came to believe that they were being denied access to information and shut out of the high-level regulatory decision making that remained in the exclusive control of the government officials and regulated fisheries. This in turn led to a breakdown in trust in the shared management process.[205]

Box. Informal Stakeholder Networks Can Improve Management Outside formally constituted stakeholder groups such as fishery or forestry councils, **informal networks** of stakeholders or community members can supply new ideas and information, which in turn allows the formal resource governance structure to respond more quickly to changes in the environment caused by climate change.[206] Because an informal network does not have authority to take action on its own, officials may consider setting up "pathways" of information exchange so that new concerns, ideas, and proposed solutions raised informally can reach the regulatory process more quickly.[207]



[205] *See* W Neil Adger, Katrina Brown, and Emma L. Tompkins, *The Political Economy of Cross-Scale Networks in Resource Co-Management*, 10 ECOLOGY & SOC'Y 9 (2005).
[206] Claudia Pahl-Wostl, *A Conceptual Framework for Analysing Adaptive Capacity and Multi-level Learning Processes in Resource Governance Regimes*, 19 GLOBAL ENVTL. CHANGE 354, 361 (2009).
[207] *Id.* at 359, 361 (2009).

Figure X. Fully-adaptive governance is a "triple-loop." Adaptive management cycles take place within larger learning cycles of "reframing" and "transformation" that go on outside the formal regulatory process. **End box**

Example: The Seychelles' National Plan of Action for shark fisheries (NPOA) contains a detailed stakeholder analysis in order to determine the entire community of people who have an interest in the sharks. It included not just the resource users themselves, but sports fisherfolk, environmental NGOs, tourism operators, and even the general public of the Seychelles. Primary resource users received preferential consideration through direct one-on-one interviews and consultations while lower-level stakeholders only qualified for a lesser degree of participation.[208] Everyone was given a seat at the table, but direct resource users received a higher status. Resource planners will need to determine whether a similar system makes sense for them.

Box. Fisherfolk Close the Arctic Fishery in Response to Climate Change
When stakeholders are brought together to manage a resource, they are often capable of making surprisingly farsighted decisions to protect it. In recent years, it has become clear the Arctic marine ecosystem faces devastating impacts from climate change. In response to the need to protect the fishery resources there, the U.S. Northern Pacific Fisheries Management Council, took action. The Council, a legally empowered governing body composed of fishing industry representatives and other stakeholders, voted unanimously in February 2009 to close the entire Arctic area to commercial fishing.[209] This decision was only possible because the stakeholders, including the fisherfolk, understood that climate change required them to act together to set aside their short-term interests to ensure long-term sustainability. "This proactive decision by the council removes one source of additional stress, giving the Arctic, its peoples and animals a better chance to adapt to the changes [brought by climate change]."[210] **END BOX**

10.5 Ensuring Compliance with Monitoring and Reporting Requirements

Key Point: Monitoring and reporting by permit holders, with proper oversight, can provide important information about how climate change is affecting an ecosystem.

Monitoring and reporting requirements are an essential aspect of an adaptive management approach to resource extraction. The CBD recommends, "[I]t is necessary for the management to monitor the effects of [resource] use and allow adjustment of the use as appropriate …. [I]t is preferable to use all sources of information about a resource when deciding how it can be used."[211] Ecological monitoring can be assigned to several different parties: the permit holder, government officials, or third parties such as an

[208] Sharks NPOA 49-52 (2007) (Seychelles).
[209] *See* NORTH PACIFIC FISHERIES MANAGEMENT COUNCIL, FISHERY MANAGEMENT PLAN FOR FISH RESOURCE OF THE ARCTIC MANAGEMENT AREA 61 (August 2009), *available at* http://www.alaskafisheries.noaa.gov/npfmc/fmp/arctic/ArcticFMP.pdf.
[210] Allison Winter, *Federal Council Approves Plan to Protect Upper Arctic*, ENERGY & ENVIRONMENT NEWS, Feb. 5, 2009.
[211] CBD SECRETARIAT, ADDIS ABABA PRINCIPLES AND GUIDELINES FOR THE SUSTAINABLE USE OF BIODIVERSITY 11 (2004).

academic institution (see section 5.3 on deciding who does the monitoring). Because institutional knowledge is so important for long-term adaptation, monitoring and reporting systems should be maintained despite changes in the ownership or control of land and resources.

Once monitoring requirements have been built into permitting, the question becomes how to ensure they are implemented, complied with, and enforced to achieve accurate and useful reporting of information. Governments can provide assistance in setting up and maintaining monitoring and feedback systems.[212] Beyond funding and other technical support, there are several mechanisms that can help ensure monitoring requirements are complied with and enforced, such as: 1) conditioning future permits on compliance with the current permit monitoring requirements; 2) requiring public disclosure statements; 3) requiring periodic reporting on monitoring efforts; 4) posting monitoring information online that can be accessed by the public; 5) authorizing citizen suits for filing false information and failing to report; and 6) using fees to support monitoring by independent third parties.

Other examples of ways to ensure effective monitoring include:

- **Auditing** ensures the ecological information reported by the permitted entity is accurate. Uganda, for example, requires that between one and three years after an EIA project has been initiated, an environmental audit be performed to ensure compliance with "predictions" made in the EIA and to mitigate any unanticipated effects.[213] In the Dominican Republic, the Environmental Ministry (SEMARENA) is authorized to perform an environmental evaluation to ensure compliance with the terms of a license by comparing self monitoring reports to the environmental audit performed by the agency.[214] The timing of audits should be randomized and without notice—this will prevent "gaming" of the system by only fulfilling the requirements around the time an audit is scheduled. Performing audits at random intervals also optimizes the limited resources of auditors.
- **Incentives** in the form of rewards for those who report that a permit holder has falsified or provided inaccurate monitoring data. This can be accomplished by extending existing whistleblower rewards to include monitoring violations, such as those Bhutan offers for reporting general forestry or wildlife-related offenses.[215]
- **Bonding** is another cost effective means of ensuring compliance with monitoring requirements. In the Dominican Republic, the environmental ministry imposes a performance bond of 10% of the value of a project to ensure compliance with terms of a project over the long-term.[216] Bonding with respect to monitoring requirements could be linked to the resolution of uncertainties identified at the outset of resource use or development. As uncertainties are resolved through the effective (and verified) monitoring effort of the resource user, the bond can be

[212] *Id.* at 12.
[213] Uganda, Environmental Impact Assessment Regulations 1998, No. 13, arts. 31-33 (Statutory Instruments Supp. to the Uganda Gazette No. 28 volume XCI dated 8th May, 1998).
[214] Dominican Republic Resolution No. 06/2004, § 46.
[215] Forest and Nature Conservation Rules § 89 (2006) (Bhutan).
[216] Dominican Republic Resolution No. 06/2004, § 47.

incrementally returned to the user.[217] Large bond requirements, however, will be most appropriate for large scale resource users with substantial financial reserves, such as multinational companies.

Box. Adaptive Capacities in Bolivia's Forest Laws In Bolivia, forests are governed by a system that could, if effectively implemented, provide important adaptive measures for climate change. Four are worth highlighting here. First, forests are governed according to the principle of "*en dubio pro forest*" (*"*when in doubt, favor the forest"), meaning that when there is evidence that a forest management practice or omission could seriously or irrevocably damage an ecosystem, "or any of its elements," forestry managers "cannot fail" to take precautionary measures to prevent or mitigate these effects.[218] Further, forest concessionaires are "obligated" to protect all natural resources, *including biodiversity*, within their permit areas, under penalty of revocation. Loggers may not export species when logging could accelerate a species into "threatened" status.[219] Each of these precautionary elements provides managers robust authority to take early action with respect to climate change impacts on the forest ecosystem.

Second, forest concessionaires are required to produce and implement long-term, sustainable Forest Management Plans (*Planes Generales de Manejo Forestal*—PGMF), to be updated every five years,[220] and Forestry Operational Plans (*Planes Operativos Anuales Forestales*—POAF), to be submitted annually. The PGMFs are to be drafted by a forest professional held civilly and criminally responsible for the accurateness and completeness of the plans.[221] The management plans must include forest inventories, species mapping, and estimates of potential output volumes.[222] If the forest management plan is approved, a POAF must then be submitted annually for approval by the Forestry Superintendence. Both land use plans and forest management plans are binding once approved.[223] These planning requirements may not expressly require adaptive management. Nonetheless, the requirement to undertake species inventories and mapping is essential to a better understanding of how the ecosystem may change under use and how it is being affected by climate change.

Third, Bolivian forestry concession rules use structural incentives to encourage long-term planning. They impose a 20-year felling period within 40-year forest concession periods, and area based fees rather than volume based taxes.[224] The 20-year felling period means only about 5% of the total forest area may be logged every year and the longer, 40-year concession period encourages more long-term forestry management practices. The fee

[217] *See* Alejandro E. Camacho, *Can Regulation Evolve? Lessons from a Study in Maladaptive Management*, 55 U.C.L.A. L. REV. 293, 357 (2009).
[218] Forestry Law No. 1700 arts. 9, 12 (1996) (Bolivia); Supreme Decree No. 24,453, art. 25 (1996) (Bolivia).
[219] Supreme Decree No. 24,453, art. 8.II.
[220] Forestry Law No. 1700, arts. 27, 30.
[221] Forestry Law No. 1700, arts. 27, 30.
[222] Supreme Decree No. 24,453, art. 69.
[223] Supreme Decree No. 24,453, art. 6.
[224] Forestry Law No. 1700, arts. 29, 33, 36.

schedule is designed to discourage selective harvesting of valuable species.[225] The concessionaire's stake in the long-term health of the forest may incentivize taking into consideration how climate change will affect the forest plot.

Finally, forest lands in Bolivia can be "immobilized," or closed, to harvesting. Lands qualifying for closure to harvesting include those that have forestry potential but warrant further study of factors such as customary rights, conservation status, and major risk factors and limitations.[226] The power to close lands temporarily for further study may provide a powerful adaptation measure that can be used to assess climate change impacts and develop response strategies prior to opening lands to extractive activities.

The Bolivia's forest laws provide the legal tools for forest adaptation to climate change. Implementing them, however, will require resources, trained personnel, and long-term commitment by the government. **End Box**

[225] Arnoldo Contreras-Hermosilla and María Teresa Vargas Ríos, SOCIAL, ENVIRONMENTAL AND ECONOMIC DIMENSIONS OF FOREST POLICY REFORMS IN BOLIVIA 13, Forest Trends and CIFOR, (2002) *available at* http://www.cifor.cgiar.org/publications/pdf_files/Books/BoliviaEnglish.pdf.
[226] Supreme Decree No. 24,453, arts. 55-58 (Bolivia).

Chapter 11 Community Based Natural Resource Management

Community based natural resource management ("community management") can provide valuable adaptation benefits for biodiversity. Community management moves on the ground decision making from centralized bureaucracies into the control of local managers and stakeholders who may be better able to respond quickly to changing conditions and new information.[227] Local and indigenous communities and other small scale resource user groups are closely dependent on local ecosystem services. They have always confronted and adapted to localized ecological complexity. Climate change intensifies that complexity by amplifying variability and uncertainty, but because impacts are localized, solutions must also be context specific. Engaging and collaborating with local communities is critical to adaptation, and traditional knowledge and customary rules for resource use are an invaluable starting point for developing locally sensitive policies strategies, and rules. The parties to the CBD recognize, "In many societies traditional and local knowledge has led to much use of biological diversity being sustainable over long time-periods without detriment to the environment or resource."[228]

In addition to fully devolved community management, this chapter will look at several methods for engaging the public and communities in climate change adaptation. While there are many adaptation benefits from community management, this chapter will also explore policy concerns that may need to be addressed.

11.1 Community Management: The Basics

Key Point: Community management can make resources more resilient to climate change while also empowering local communities and supporting local livelihoods. Where climate impacts are severe, however, central governments have an essential supportive role to play.

Community management "rests on the recognition that local communities must have direct control over the utilization and benefits of natural resources - wildlife, [forest] products - in order to value them in a sustainable manner. Community management is both a conservation and rural development strategy, involving community mobilization and organization, institutional development, comprehensive training, enterprise development, and monitoring of the natural resource base."[229] Community management empowers communities to manage their own resources in order to protect them from internal mismanagement and livelihood degrading activities of outside individuals or entities. It provides co-benefits in biodiversity conservation, cultural conservation, and poverty reduction.[230]

---

[227] *See* Daniel J. Klooster, *Toward Adaptive Community Forestry Management: Integrating Local Forest Knowledge with Scientific Forestry*, 78 ECON. GEOG. 43 (2002).
[228] CBD SECRETARIAT, ADDIS ABABA PRINCIPLES AND GUIDELINES FOR THE SUSTAINABLE USE OF BIODIVERSITY 11(2004).
[229] Botswana CBNRM Support Programme, Community-Based Natural Resources Management in Botswana, http://www.cbnrm.bw/ (last visited March 15, 2010).
[230] Andersen, F. K. & Long, B., *An Assessment of, and Lessons Learnt from, two Pilot Community-Based Natural Resource Management Mechanisms in the Truong Son*

Box Community Management of Coral Reefs Traditional management techniques used by indigenous communities could be effective at reducing local stresses on coral ecosystems, allowing them a better chance to adapt to climate change. **Periodic closure** is a dynamic cycle of opening and closing harvesting within prescribed areas employed in Kakarotan, Indonesia and Muluk Village, Papua New Guinea (PNG).[231] In both cases, the biomass and average size of fishes were greater inside the periodic closure areas compared to control sites.[232] Another study comparing reef conservation at four national parks, four co-managed reserves, and three traditionally managed areas in Indonesia and PNG found that the size and biomass of fish were higher inside the traditionally managed areas.[233] Evidence suggests the indigenous communities are more sensitive to climatic shifts. In Kakarotan, a reef area was closed for an entire year coinciding with a severe El Niño bleaching event.[234] By studying these areas, policymakers can improve understanding of the socio-economic conditions needed to support localized adaptive management.[235] **End Box**

The benefits of community management have been observed around the world. In the South Pacific, for example, allowing local island communities to retain management control over their resources has been documented to provide social and environmental benefits:

- Localized recovery and protection for vulnerable species in Vanuatu
- Improved fishery landings in the Philippines
- Improved community decision making, support networking, political influence and compliance and enforcement in Southeast Asia
- Development of community organizations for other endeavors in the Solway Firth
- Heightened resilience and adaptive capacity to respond to new threats in Fiji
- Health benefits in the form of secure access to marine proteins
- Integration of management across sectors, such as watersheds and waste disposal
- Cultural survival through use of traditional management practices and ecological knowledge such as respect for taboo areas that are closed to fishing
- More secure tenure in ownership rights and access to livelihood resources[236]

Mountains, Vietnam. WWF Greater Mekong – Vietnam Programme, Quang Nam Forest Protection Department, Pu Huong Nature Reserve & Danida, Hanoi (2006).

[231] Almany, G.R., J. Cinner, M.J. Marnane, T.R. McClanahan. "Periodic Closures as Adaptive Coral Reef Management in the Indo-Pacific." *Ecology and Society* 11.1 (2005): pg 32

[232] *Id.* at 37.

[233] McClanahan, T. R., M. J. Marnane, J. E. Cinner, and W. E. Kiene. "A Comparison of Marine Protected Areas and Alternative Approaches to Coral-Reef Management." *Current Biology* 16 (2006): pg 1408

[234] Almany et al., *supra* note X, at 35.

[235]

[236] Hugh Govan, *Overview: Reclaiming "Protected Areas" as a Livelihood Tool for Pacific Island People*, *in* ANNOTATED BIBLIOGRAPHY OF SOCIO-ECONOMIC AND ECOLOGICAL IMPACTS OF MARINE PROTECTED AREAS IN PACIFIC ISLAND COUNTRIES (P. Cohen et al., eds. 2008).

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.[237]

Example: Hybrid public-private systems have developed in Nepal in which individuals lease plots of public land for 25 and 40 years, respectively, for restricted use. These arrangements have proven successful for restoring degraded land because they provide more secure tenure. Strong land tenure is essential for reducing vulnerability to climate change by ensuring access to the forest's resources and giving the local people a stake in the resilience of their forest.[238] To date, Nepal's rules have been based on local institutional understandings and are not grounded in official laws or policies.[239] This may be the next step for the Nepalese government to take to further reduce vulnerability.

11.2 Promoting Community Awareness about Climate Change

Key Point: Communities informed about the measures others have taken to respond to climate change impacts similar to those they face are more likely to accept the need for and to develop their own adaptation measures.

Engaging the public at the community level allows planners, policymakers, and managers to determine local attitudes about climate change impacts, to provide educational opportunities, awareness, and outreach, and to build a stronger sense of solidarity across levels of governance. Involvement in adaptation activities allows participants to "own" both the problem and its solution through informed engagement.

Public outreach can inform officials about local attitudes toward climate change. In some cases, officials will find that communities are responding to changes they are already seeing, such as extremes in increased variability, which are often good proxies for future climate change. Identifying responses to the immediate variability, therefore, often serves as a first step toward responding to the longer-term changes. In other cases, the population may not recognize climate change impacts as being caused by climate change. For example, a survey of coffee farmers in rural regions of Mexico, Guatemala, and Honduras revealed key community attitudes demonstrating an indifference or a lack of power to control that those developing adaptation strategies need to consider. The survey showed that:

- Changes in climate such as temperature increases and longer dry periods had been noted by local farmers, but the farmers did not prioritize them or develop responses. Farmers were more concerned with market forces than the climate

[237] James Sanderson et al., *Escaping the Minimalist Trap: Design and Implementation of Large-Scale Biodiversity Corridors*, *in* CONNECTIVITY CONSERVATION 638 (Kevin. R. Crooks and M. Sanjayan eds. 2006).
[238] Bharat K. Pokharel & Sarah Byrne, Climate Change Mitigation and Adaptation Strategies in Nepal's Forest Sector: How Can Rural Communities Benefit, NSCFP Discussion Paper No. 7, at 29 (2009).
[239] Peter Glück et al., Governance and Policies for Adaptation, *in* ADAPTATION OF FORESTS AND PEOPLE TO CLIMATE CHANGE: A GLOBAL ASSESSMENT REPORT, IUFRO World Series vol. 22, at 198-99 (Risto Seppälä et al. eds., 2009).

change impacts because the former were perceived as both more pressing or within their power to influence. One smallholder farmer in Guatemala said, *"I'm not very worried about the climate, although it does affect my harvests, because it is beyond my control."*

- The study found a lack of initiative in both smallholder farmers and at regional and national levels of government to focus on environmental impacts in the coffee growing industry and in the farmers' success in the face of climate risk. There was a lack of communication among farmers and between farmers and the national government, including information about technological advancements and climate change impacts in the region.[240]

Resource users can be shown that they do indeed have control over many aspects of environmental management that will reduce their vulnerability to climate change and build the capacity for ecologically sustainable livelihoods. In some areas people may be unaware that climate change is responsible for changes in their environment; they may not believe climate change is actually occurring; or they may not believe they have any power over its effects.[241] Governments and civil society can reach out to these populations to inform them of the impact climate change likely will have in their region and identify constructive methods of responding and adapting to those changes.

Methods of responding to a sense of climate helplessness within a community include:

- Establishing and promoting local level organizations, associations, or committees to share ideas and experiences
- Establishing and promoting local environmental planning initiatives to give communities empowerment and control over resources
- Establishing community-to-community networks of information exchange (research shows people are much more likely to heed the advice of peers than authority figures)

11.3 Using Local Knowledge of the Climate and Adaptation Strategies

Key Points: Traditional and indigenous knowledge can provide cultural continuity in times of great change and invaluable information on effective strategies for adapting to climate changes that can be shared with other regions and communities.

Traditional and indigenous knowledge is an invaluable source of information on climate change and locally appropriate methods of adapting. This knowledge includes the ability to interpret meteorological and climatic phenomena, manage ecological relations between

[240] H. Eakin et al., *Market Shocks and Climate Variability: The Coffee Crisis in Mexico, Guatemala, and Honduras*, 25 MOUNTAIN RESEARCH AND DEVELOPMENT 204 (2005).
[241] For a collection of African perspectives on climate change for example, see Africa Talks Climate, http://africatalksclimate.com/ (last visited August 20, 2010).

society and nature, and adapt to environmental and social change.[242] Surveys, interviews, and other methods of gaining information about ecological conditions from local residents complement scientific data and enhance adaptation efforts.[243] People living close to managed resources will be able to provide researchers and managers first person perceptions of changes in their environment over time.[244] Biologists in Alaska, for example, found that traditional Inupiat knowledge about the Arctic provided hypotheses that could be tested, laying the foundation for collaborative research on subsistence resources.[245]

In order to ensure respect for, the appropriate use of, and, in some cases, compensation for, access to local knowledge, countries could establish legal programs and other safeguards so that the benefits of local knowledge do not flow only to outside managers or researchers. The following considerations should be kept in mind:

- Indigenous people have been adversely affected by expropriation of their knowledge and the failure to obtain voluntary, prior, informed consent for its use
- Agreements can be negotiated to ensure benefits from advances in climate adaptation resulting from use of local knowledge are shared with the indigenous people who provided the information
- Traditional knowledge has value (economic, aesthetic, and spiritual) apart from its use for climate adaptation or other scientific or policy purposes, and these other values should be respected by outside users, researchers, and officials

With the informed consent and cooperation of local or indigenous people, researchers can work toward identifying two key types of information that may be useful in developing methods for adapting to climate impacts.

(1) The historic trends of the climate of a region and its effect on ecology

Example: In Bolivia, the National Climate Change Program was set up to identify climate change vulnerability in indigenous communities living in dry mountain lands. The Program's goal was to analyze climate change effects in the region and work towards creating adaptive strategies.[246] The Program found that indigenous communities in Bolivia had recorded changes in the climate by observing alterations in animal behaviors and plants over multi-year periods. From these observations the communities predicted

[242] INT'L COUNCIL FOR SCIENCE, SCIENCE, TRADITIONAL KNOWLEDGE, AND SUSTAINABLE DEVELOPMENT 9 (2002).
[243] Vulanerabilidad y Adaptacion al Cambio Climactico en Bolivia, Programa Nacional de Cambios Climacticos, Republica de Bolivia, at 4.
[244] *See, e.g.*, Kenneth R. Young & Jennifer K. Lipton, *Adaptive Governance and Climate Change in the Tropical Highlands of Western South America*, 78 CLIMATE CHANGE 63 (2006).
[245] George Noongwook, The Native Village of Savoonga, The Native Village of Gambell, Henry P. Huntington, & John C. George, *Traditional Knowledge of the Bowhead Whale (*Balaena mysticetus*) around St. Lawrence Island, Alaska*, 60 ARCTIC 47 (2007).
[246] Vulanerabilidad y Adaptacion al Cambio Climactico en Bolivia, Programa Nacional de Cambios Climacticos, Republica de Bolivia.

how their food, resources, and farming patterns would be affected. Fifty percent of the population identified drought as a major issue as opposed to only 30% ten years earlier.

(2) Local methods for adapting or coping with those changes that have been effective in the past

Example: The remote village of Quezungal in Honduras was one of only a few communities that did not lose its entire crop to Hurricane Mitch in 1998. Researchers found that the Quezungal people's use of traditional farming methods, such as interplanting crops with trees to prevent soil erosion and pruning vegetation to reduce water use, provided protection against the effects of the hurricane. Farming methods taught in agriculture colleges and practiced in neighboring regions were based on agriculture methods suited for the plains areas but not for the Honduran terrain, making the crops vulnerable to failure from one severe weather event. The Quezungal method is being promoted around the country in the Watershed Protection Program set up by the Honduran government and the U.N. Food and Agriculture Organization.[247]

Figure X. The Lakota Winter Counts. Indigenous peoples in the Great Plains of North America used bison hides to track major events in the community's life. Often these pictograms show responses to weather events, allowing contemporary tribal communities to develop strategies for climate change rooted in the community's own history.[248] Similar cultural resources can support climate adaptation measures in other regions.

11.4 Policy Concerns Surrounding Community Based Management

Key Point: Before carrying out a community based climate adaptation program, policymakers must determine that the right social and political conditions exist for the transfer or devolution of power to the local communities. **End box**

> *Rather than enfranchising local people under democratic decentralization, choosing nondemocratic authorities may—as under the colonial policies*

[247] *See* IUCN, VISION FOR WATER AND NATURE: A WORLD STRATEGY FOR CONSERVATION AND SUSTAINABLE MANAGEMENT OF NATURAL RESOURCES 79 (2000).
[248] Bob Gough, Secretary, Intertribal Council on Utility Policy, Tracking the Changing Climate on the Upper Great Plains, presentation at Mother Earth: Confronting the Challenge of Climate Change, National Museum of the American Indian, Smithsonian Institution, Washington, DC (June 27, 2009), *available at* http://www.nmai.si.edu/motherearth/2009/audio_archive.html.

> *of "indirect rule" and "association"—subject local people to arbitrary authority without representation, rights, or recourse.*[249]

Decentralization of resource management authority has taken place in many countries. As the sections above demonstrate, local control and management of common pool or collectively owned natural resources can be highly adaptive to changing ecological conditions. Localized management regimes take place at a scale more often commensurate to a particular ecological region or context (though this is not always the case).[250] As such, allowing for the continued existence of these regimes, fostering their growth, and providing support for them (for example, by mediating conflicts arising from the in-migration of new groups) are all steps governments and NGOs can take to build adaptive capacity for climate change among natural resource users.

Caution and strategic planning, however, are important to ensure the effective and democratic transfer of natural resource management to the community level. There are many potential policy issues and problems that may arise when natural resource management is handed to local level systems of government. Some of these issues that need to be considered and addressed include:

- Partial transfers of power that create regulatory confusion or fail to sufficiently devolve power to the local communities(see figure X)
- Elected local leaders who may feel greater political pressure than those in the centralized ministries to allow unsustainable resource use in response to scarcity or crisis
- Newly empowered local agencies' lack of accountability to community members and to centralized ministries
- Methods for ensuring the secure transfer of authority to local officials through constitutional guarantees and for limiting ministerial discretion in carrying out transfers of authority
- Proper role of discretion and institutional choices given considerations of scale and capacity
- Use of customary institutions and authorities that may be inequitable to one or more demographics (for example, entrenchment of male-dominated hierarchies)
- Protections for marginal groups such as ethnic or religious minorities within the local arena
- Local level elites' tendency to take resources for themselves or their relatives (elite capture and patronage), leaving the non-elite community members with fewer resources and frustrating democratic governance
- The presence and authority of a strong central government as a backstop for environmental protections if the local governance fails
- Use of privatization of natural resource management alone as an inadequate substitute for true devolution of power to local communities

[249] JESSE C. RIBOT, DEMOCRATIC DECENTRALIZATION OF NATURAL RESOURCES: INSTITUTIONALIZING POPULAR PARTICIPATION 12 (World Resources Inst. 2002).
[250] Bradley C. Karkkainen, *Collaborative Ecosystem Governance: Scale, Complexity, and Dynamism*, 21 VA. ENVTL. L.J. 189, 206-08 (2002).

- Effective enforcement of minimal environmental standards[251]

These issues, especially those related to the need for checks and balances at the local level or through complementary or "backstop" authority at a centralized level, suggest a continuing role for central governments. In countries with decentralized resource management, the central ministries will not only have supportive roles to play in implementation of customary or village level regimes. They must play an active regulatory role on questions that are uniquely within the central government's competency.

Sidebar. Elinor Ostrom's Eight Design Principles for Common Pool Resource Management

Elinor Ostrom was awarded the Nobel Prize in economic sciences in 2009 for her life's work on common property ownership. Her eight 'design principles' for successful common pool resource governance are useful to keep in mind when transferring authority for resource management to the local level:

1. Clearly defined boundaries on who has the right to use the resource as well as the boundaries of the resource itself
2. Rules regarding the appropriation of common resources that are adapted to local conditions
3. Collective-choice arrangements that allow most resource appropriators to participate in the decision making process
4. Effective monitoring by monitors who are part of or accountable to the appropriators
5. A scale of graduated sanctions for resource appropriators who violate community rules
6. Cheap and easy access mechanisms for conflict resolution
7. Self-determination of the community that is recognized by higher-level authorities
8. For large-scale resources: organization in the form of multiple layers of nested enterprises and local community pool resources at the base level.[252] **End Sidebar**

Legal frameworks for climate adaptive community management should address two equally compelling policy concerns:

(1) Adaptive regimes must provide local or community resource managers the discretion and flexibility to make quick decisions about resources under changing ecological conditions without burdensome regulatory requirements, intrusion by central officials, or constant judicial intervention; *but*

(2) Ensuring resource managers adhere to the rule of law requires checks and balances to determine whether they are providing equitable access to resources both within and between communities, transparency and public participation in

[251] JESSE C. RIBOT, WRI REPORT, WAITING FOR DEMOCRACY: THE POLITICS OF CHOICE IN NATURAL RESOURCES DECENTRALIZATION (2004).
[252] ELINOR OSTROM, GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION (1990).

decision making, and offering recourse to those who believe themselves aggrieved by a local authority's decision.

To address these two policy concerns, it may help to categorize types of resource management decisions. Three categories of decisions can be identified: (1) those choices that are properly within the discretion of local resource managers; (2) those choices that require decentralized and centralized authorities to work together; and (3) those choices that are most appropriately resolved by national level authorities. An illustrative list is presented in Table X; however, the assignment of responsibilities is highly context specific, and depends on local laws, policies, and social conditions. (Caution: This approach may be inappropriate in the case of lands or resources over which an indigenous people hold sovereign powers; in such cases decentralization is often not a question of strategy but a matter of rights.)

Table X. Possible Delegation between Local and Central Authorities

Decisions for Local Authorities	Decisions to be made Jointly	Decisions for Central Authorities
Timing of opening of season for hunting, fishing, or gathering of resources	Distribution of resources among user groups	Enforcement of constitutional rights and protections
Permitted harvesting techniques, including types of technology used and timing of harvests	Assessments of equity and democratic representation in local management processes	Enforcement of other human rights (e.g., gender and racial equality)
Setting access fees and small civil penalties	Public participation and transparency requirements	Use of force to secure control of resources
Monitoring of compliance and ecological indicators	Total amount of resources to be allowed extracted	Compliance with international treaty obligations
Establishment of temporary protected areas to allow resource replenishment	Budgetary and financial choices, especially with respect to grant projects or private sector initiatives	Decisions with respect to migrant human populations
Traditional, customary, or religious practices or rituals governing resource use or access	Decisions on exploitation of sensitive, threatened, or endangered species	Decisions on national policies to address global environmental problems

11.5 Case Study: Adaptive Community Management in Mali

Key Point: Local or indigenous resource management may already be highly adaptive to changing ecological conditions at local to regional scales. Investigation of these practices is a necessary first step to developing and implementing climate adaptation policies there.

The communities in Mali's Inner Niger Delta area of the African Sahel provide a useful case study in resource management structures that can adapt to changing ecological conditions. [253] Because of the severe climatic shifts that occurred in this region over the twentieth century and the effective management responses organized by communities there, important lessons may be drawn for climate adaptive community management elsewhere.[254] An additional lesson is that traditional legal safeguards to protect customary rules and norms, as embodied in Article 8(j) of the Convention on Biological Diversity, can be an important part of legal adaptation strategies.

Researchers in Mali identified three basic levels of governance where "collective action problems" were addressed: the village, inter-village relationships, and the regional level.

The Village Level

Adaptive common pool resource management at the village level included:

- Flexible rules on timing of access to a resource, techniques used for harvesting, and who may have access
- Enforcement bodies that monitor a resource area and apprehend rule breakers
- Fines or other penalties that are negotiable depending on the severity of the offense and the attitude of the rule breaker
- Community based institutions (for example, an assembly of all heads of households) that have power to modify rules or practices

An example of the adaptive capacity of these village level structures is demonstrated in one village's management of a 110-hectare forest along the Tarabé River. Since the 1970s this small forest has become highly productive through the stringent management of access and tree cutting. Ultimate decision making authority rests with the village chief, but he rarely acts without the consensus of the household heads. The choice of opening date is seasonal, depending on the rate at which flooding recedes from the area, opening up a passageway for access. For one month before the opening date, the village hires a guard to prevent unauthorized entry.

Adaptation to at least some climate change effects is possible in this regime, because there exists a relatively simple and consensus based decision making process that allows the village to modify the opening date of access each year, which may fluctuate based on environmental conditions. Further, enforcement of the rules is possible through (1) a respected traditional regime and (2) a paid guard.

[253] Information in this section is adapted from 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).

[254] This case study helps us understand the range of management activities, structures, and protocols that may be in place in local or indigenous communities. It is not intended to suggest there is any "typical" village or social arrangement for which adaptive community management works better than others. These rules and institutions are highly localized and are not necessarily appropriate for exporting to other regions.

The Inter-village Level

Structures at the inter-village level for adaptive governance of common pool resources in Mali include:

"Polycentric" resource control and access regimes

In the Sahel region, waters and fisheries are often "owned" by different entities, as are the riverbeds and the underwater vegetation along those riverbeds. Aquatic grasses may be owned separately from the land upon which they grow. This system recognizes multiple use ownership rights over the same area of land or water. Research is needed as to how and why the ownership rules developed this way. It can be speculated, however, that multiple use ownership may prevent any single entity from acting unilaterally on a resource without the input of other interested parties.

Special authority for resource decisions vested in persons who do not draw their authority from any one village's hierarchy

In some cases, management control of a resource can be distinct from the ownership of the land or water where that resource is located. In the village of Badiari, management of forest resources is undertaken by the *Beme*, a community forest association made up of all male villagers between the ages of 15 and 55 and under the control of a *Beme* chief, while agricultural decisions are made by the village chief in consultation with household heads. In the same region, decisions on the opening date of the fishing season are made by "shaman-like water chiefs … whose residence has little relation to the territories in which the fishing spots are located." This structure for resource governance may allow for a diffusion of power among multiple authorities in a given area so that no one person or group is able to control all the resources, encouraging consensus building in decisions.

Joint policing of resource use through inter-village institutions

As with village level resource management, at the inter-village level there must be a method of enforcement for resource use rules. In the Inner Niger Delta, once the water chiefs have declared a fishery open, a group of "police" called *walangari* governs the fishing activities. The *walangari* are selected by councils from each of the participating villages. On location, they self organize by seniority and possess delegated authority over all the fisherfolk regardless of village of origin. By selecting those charged with enforcing the rules from the ranks of all the villages that wish to fish, the *walangari* possess legitimacy to ensure compliance with the rules.

The Regional Level

At the regional level, climate change may cause larger scale conflicts over resources that may strain the capacity for community resource management to resolve. Therefore, there may be a greater role for central governments to support adaptive community

management institutions that mediate resource conflicts and respond to changing ecological conditions. These institutions may include:

Long-standing conventions between outside resource users who traditionally pass through an area and local villagers

These conventions may be expanded to address new issues arising from migration of new groups of people. Examples of these types of conventions in Mali include those that ban certain unsustainable technologies for resource extraction (e.g., , a ban on the use of highly efficient "pound nets" that are recognized to cause fishery depletion) and a ban on agricultural cultivation in those areas known to be traditional corridors for herd migration, including areas set aside for herder encampments. The permanent settlement of persons displaced by climate change may prove a more difficult situation for the traditional structure to accommodate, and government interventions to address that issue may become more necessary.

Activities that help outside resource users, such as herders, fisherfolk, and other outside migrants, learn about and comply with local rules governing resource use
Migrating populations may come from distant regions and have no familiarity with local rules (unlike pastoralist populations who have an historical presence in an area). Likewise, the resident population of resource users may respond inhospitably to outsiders not familiar with their customs. The supportive activities for government might include:

- Education of newcomers to the local customs, preventing resource conflicts before they arise
- Organization of meetings between resident and outsider groups at which new conventions and agreements can be reached regarding resource use
- Intervention in disputes to prevent violence, adjudicate fair resolutions, and ensure local customs are upheld to the extent practicable under changed or degrading ecological conditions

Relaxation of local rules for migrant populations during periods of hardship

The Malian villages relax certain rules to the benefit of outsider populations during "hardship" periods. These periods can result from climate driven events, such as extreme flooding or drought. Some villages, for example, have opened up access to non-timber forest products such as famine foods (crops that can withstand harsh conditions and provide enough nutrition for survival). Outside officials and NGOs may have a role to play in mediating special resource privileges between outside groups and resident populations

Chapter 12 Protected Areas on Public Lands and Waters

Climate change poses a challenge for existing protected areas (both land-based and marine) and the design and establishment of new ones.[255] Most protected areas continue to be "managed" primarily by sealing the borders to development and allowing nature to "run its course."[256] Climate change calls into question whether a small reserve area can be set aside while the rest of the landscape is fragmented and degraded by human development.[257] When climate conditions exceed the range that species can tolerate, they will likely attempt to move to a new location.[258] The varying paces at which species will be able to seek out more suitable habitat, if at all, will create new species community compositions and novel habitat arrangements.[259]

At the same time, people seeking relief from the impacts of climate change will put increasing pressure on officials to open up protected areas for settlement and use of resources (see Chapter 10.3). Ecosystems' complex, non-linear, and unpredictable responses to climate change, and human needs to adapt, strongly point to the need for a **landscape level approach** to protected areas. This approach brings core habitats, corridors, and mixed use or human occupied areas under various levels of protection, in order to give species a wide range of choices for movement,[260] while also accommodating human development needs.[261] Ultimately, the end goal is not 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 and reassemble.[262]

It is not possible, however, to place under full public protection all the area needed for species' adaptation to climate change without causing serious social and political destabilization. Three points emerge:

- Public protected areas networks need to be reconfigured to maximize climate resilience using limited public resources
- Conservation and habitat restoration on private lands is essential

---

[255] PATTY GLICK ET AL., NAT'L WILDLIFE FED., A NEW ERA FOR CONSERVATION: REVIEW OF CLIMATE CHANGE ADAPTATION LITERATURE 14-15 (2009).
[256] P. Bernier & D. Schoene, *Adapting Forests and their Management to Climate Change: An Overview*, *in* UNASYLVA 231/232 vol. 60, at 7 (A. Perlis ed. 2009).
[257] J.J. HOPKINS ET AL., CONSERVING BIODIVERSITY IN A CHANGING CLIMATE: GUIDANCE ON BUILDING CAPACITY TO ADAPT 15 (2007).
[258] PATTY GLICK ET AL., *supra* note X, at 15; Reed F. Noss, *Beyond Kyoto: Forest Management in a Time of Rapid Climate Change*, 15 CONSERVATION BIO. 578, 580 (2001).
[259] David Welch, *What Should Protected Areas Managers do in the Face of Climate Change*, 22 GEORGE WRIGHT FORUM 75, 79 (2005).
[260] S. Mansourian et al., *The Role of Forest Protected Areas in Adaptation to Climate Change*, *in* Unasylva 231/232 vol. 60, at 63 (A. Perlis ed. 2009).
[261] *See* Nigel Dudley and Sue Stolton, *Ecological and Socio-economic Benefits of Protected Areas in Dealing with Climate Change*, *in* BUYING TIME: A USERS' MANUAL FOR BUILDING RESISTANCE AND RESILIENCE TO CLIMATE CHANGE IN NATURAL SYSTEMS 217, 218 (Lara Hansen et al., 2003), *available at* http://www.panda.org/about_our_earth/all_publications/?8678/BUYING-TIME-A-Users-Manual-for-Building-Resistance-and-Resilience-to-Climate-Change-in-Natural-Systems.
[262] P. Kareiva and M. Marvier, *Conserving Biodiversity Coldspots*, 91 AM. SCI. 344 (2003).

- Coordination of private and public efforts will maximize the adaptation benefits of both

A landscape level approach to habitat conservation encompasses fully protected areas (such as wildlife reserves or wildernesses) as well as human uses that take place between those areas. Appropriately managed matrix lands (those lands outside of the protected areas) can enhance connectivity between reserves without necessarily requiring the removal of human communities and activities.[263] As climate change shifts habitat conditions, matrix lands may replace protected areas as primary habitat. Approaching habitat protections from the perspective of matrix management builds the adaptive capacity of ecosystems and biodiversity as well as human communities who rely on natural resources for livelihoods and economic development.[264]

This chapter covers the following topics:

- Building climate resilience into the design of protected areas
- Improving connectivity between protected areas
- Aligning community roles and benefit sharing with adaptation
- Creating transboundary and international protected areas networks
- Translocating Species: Legal and Policy Considerations

12.1 Building Climate Resilience into the Design of Protected Areas

Key Point: Policymakers need to be strategic in selecting areas for conservation, preservation or restoration. The areas chosen should be part of a comprehensively designed protected areas network that is ecologically sensitive and attuned to the impacts of climate change on individual species and habitat types.

Adding lands to the existing system of protected areas has been identified as the chief policy objective in adapting biodiversity conservation to climate change.[265] Policymakers should seek to design protected area networks to anticipate those sites that will remain or become viable centers of evolution and conduits to facilitate species' range shifts under a plausible range of long-term climate scenarios.[266] The emerging field and improving technology of regional and local bioclimatic modeling can help policymakers determine

[263] G.P. VON MALTITZ ET AL., ADAPTING CONSERVATION STRATEGIES TO ACCOMMODATE IMPACTS OF CLIMATE CHANGE IN SOUTHERN AFRICA, S. Africa AIACC Working Paper No. 35, at 20 (2006); Paul F. Donald & Andy D. Evans, *Habitat Connectivity and Matrix Restoration: the Wider Implications of Agri-Environment Schemes*, 43 J. APPLIED ECOLOGY 209, 214 (2006).
[264] Lee Hannah et al., *Climate Change-Integrated Conservation Strategies*, 11 GLOBAL ECOLOGY & BIOGEOGRAPHY 485 (2002).
[265] ALISON CAMPBELL ET AL., UNEP WORLD CONSERVATION MONITORING CENTRE, THE LINKAGES BETWEEN BIODIVERSITY AND CLIMATE CHANGE MITIGATION 30 (2008).
[266] Ad Hoc Technical Advisory Group on Biodiversity and Adaptation to Climate Change, Guidance for Promoting Synergy Among Activities Addressing Biological Diversity, Desertification, Land Degradation and Climate Change, CBD Technical Series No. 25, at 8 (2006); ALISON CAMPBELL ET AL., UNEP WORLD CONSERVATION MONITORING CENTRE, THE LINKAGES BETWEEN BIODIVERSITY AND CLIMATE CHANGE MITIGATION 31 (2008).

where these sites are located (See Box).[267] Meanwhile, ecological science already provides many ideas for priorities in designing future protected areas:

- **Tailor restoration targets to future conditions, not historic ones:** Well intentioned restoration efforts will fail if they do not consider the impacts of climate change on the viability of the site selected for restoration or the objectives of the restoration.[268] Valuable and limited community, agency, and NGO resources will be squandered on projects that may fail because they did not account for future conditions at the site (e.g., mangroves restoration in areas that will be inundated by sea level rise).
- **Protect the ecosystem and its functions:** Species specific conservation strategies may shortchange the larger goal of protecting whole ecosystems and the functions that build resilience in the system to climate change.[269] Any one species is part of a thriving network of relationships. Protecting the whole system rather than just one component of it ensures the largest number of species is protected. In some cases, conservation of an keystone species will provide valuable protected space for an entire ecosystem. For example, African elephants require large areas to move, so conservation strategies for them necessarily protect many other species as well.[270]
- **Protect heterogeneous habitat areas:** As species try to keep up with climate change, they will look for new places with either conditions like those that they are used to or that give them other advantages given the environmental changes taking place. To support the development of robust, vibrant natural communities, it is beneficial to protect and foster **heterogeneous landscapes, or complex and variable systems,** with a diversity of options for species to take advantage of. This is bet hedging: without knowing exactly what change will occur or the conditions that will prove beneficial, protecting a variety of types increases the likelihood of success.[271]
- **Preserve and enhance access to "climatic refuges":** These are areas that, due to their location or inherent stability are expected to change the least in response to climate change. Conserving these areas provides protection for species and ecosystems that have the best chance of weathering global climate change.[272]

---

[267] *See* BASTIAN BOMHARD AND GUY MIDGLEY, IUCN WORLD COMMISSION ON PROTECTED AREAS, SECURING PROTECTED AREAS IN THE FACE OF GLOBAL CHANGE: LESSONS LEARNED FROM THE SOUTH AFRICAN CAPE FLORISTIC REGION: A REPORT BY THE ECOSYSTEMS, PROTECTED AREAS AND PEOPLE PROJECT 31 (2005) (noting the importance of using regional-scale rather than global models)..

[268] *See* J.P. McCarty and J.B. Zedler, *Restoration, Ecosystem, in* THE EARTH SYSTEM: BIOLOGICAL AND ECOLOGICAL DIMENSIONS OF GLOBAL ENVIRONMENTAL CHANGE 532 (H.A. Mooney and J.G. Canadell eds., vol. 2, 2002).

[269] W.J. Junk, *Long-term Environmental Trends and the Future of Tropical Wetlands*, 29 ENVTL. CONSERVATION 414 (2002).

[270] *See* P.J. STEPHENSON, WWF SPECIES ACTION PLAN: AFRICAN ELEPHANT 2007-2011 (2007), *available at* http://assets.panda.org/downloads/wwf_sap_african_elephants_final_june_2007v1_1.pdf.

[271] *See* IPCC, WORKING GROUP II, CLIMATE CHANGE 2001: IMPACTS, ADAPTATION, AND VULNERABILITY ¶ 19.3.3.3 (2001) (noting the importance of protecting ecotones, areas where different ecosystem types meet).

[272] Stacey Combes, *Protecting Freshwater Ecosystems in the Face of Global Climate Change, in* BUYING TIME: A USERS' MANUAL FOR BUILDING RESISTANCE AND RESILIENCE TO CLIMATE CHANGE IN NATURAL SYSTEMS 177, 199-200 (Lara Hansen et al., 2003).

Resources Box. Using Bioclimatic Modeling to Site Protected Areas

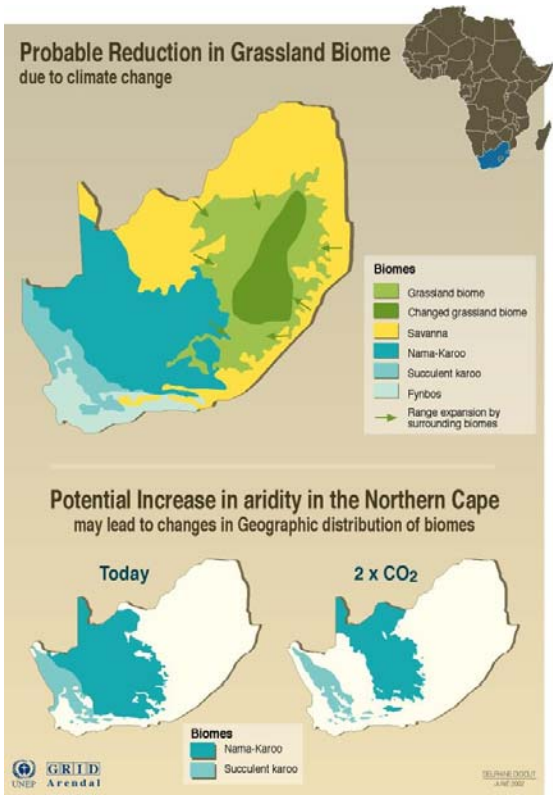
Bioclimatic modeling is an effective tool to inform the selection of locations for protected areas that will provide the most ecological resilience to climate change. Bioclimatic models combine location- and species-specific information with climate change scenarios to project the rates, magnitudes, and directions of the responses of different species and regions to climate change. These models can be useful in helping to design a network of protected areas and connectivity measures that can adapt to climate change.[273] Some regional modeling tools are already available for conservation planners. These include:

- SERVIR is a regional visualization and monitoring system for Central America and Africa for improved scientific knowledge and decision making. SERVIR addresses the nine societal benefit areas of the Global Earth Observation System of Systems (GEOSS): disasters, ecosystems, biodiversity, weather, water, climate, oceans, health, agriculture and energy. http://www.servir.net.
- Climate Change Explorer provides users with an analytical foundation from which to explore the climate variables relevant to their particular adaptation decisions. The approach links vulnerability, monitoring, and projecting climate hazards with planning adaptation processes. The Climate Change Explorer (CCE) provides an interface for downloading, managing and visualizing scaled down model outputs. http://wikiadapt.org/.
- The World Bank Climate Change Portal provides quick and readily accessible global climate and climate related data to the development community. The site allows users to access data such as the outputs from climate models, historical climate observations, natural disaster data, crop yield projections and socioeconomic data at any point on the globe. http://sdwebx.worldbank.org/climateportal/.
- The German Nature Conservation and Nuclear Safety (BMU) is developing a global and regional adaptation support platform called Climate Impacts: Global and Regional Adaptation Support Platform (CI:grasp). www.ci-grasp.org.

While these models have potential, they also have significant limitations and should be used with caution.[274] Planners using bioclimatic models also need to consider changes in human activities and work with urban planners and developers to plan protected areas and migration pathways. For example, the modeling in Madagascar projected that under future climate change scenarios, the most effective locations for protected areas overlap with locations where rice farming would be most productive.[275] This knowledge may

[273] Lee Hannah et al., *Conservation of Biology in a Changing Climate*, 16 CONSERVATION BIO. 264, 266 (2002); BASTIAN BOMHARD AND GUY MIDGLEY, IUCN WORLD COMMISSION ON PROTECTED AREAS, SECURING PROTECTED AREAS IN THE FACE OF GLOBAL CHANGE: LESSONS LEARNED FROM THE SOUTH AFRICAN CAPE FLORISTIC REGION: A REPORT BY THE ECOSYSTEMS, PROTECTED AREAS AND PEOPLE PROJECT 31 (2005).
[274] Lee Hannah et al., *Climate Change-Integrated Conservation Strategies*, 11 GLOBAL ECOLOGY & BIOGEOGRAPHY 485, 487 (2002); 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, 788 (2005).
[275] Lee Hannah et al., *Climate Change Adaptation for Conservation in Madagascar*, 4 BIO. LETT. 590 (2008).

allow planners to negotiate a balance of uses in an area prior to the period when that area will come under most stress.



Climate impacts to grassland ecosystem in the Cape floristic region of South Africa.[276]

End Box

Policies and legal authorities governing how and where protected areas are created need to consider how climate change will impact their ecological goals. Given the high level of species movement anticipated from climate change, some biodiversity conservationists have proposed that conservation officials be given the legal authority to modify the location of existing protected areas as bioclimatic conditions change.[277] Where and how areas are selected for protection may need to be more dynamic than in the past. However, there are two concerns with overly flexible, shifting areas of protection. First, this may be politically impossible to carry out in practice. The administrative requirements of decommissioning and establishing new protected areas across a country as the climate changes would be burdensome, and the costs of buying out landowners or moving existing human populations would be high. Moreover, there are high levels of uncertainty associated with fluctuating protected area status. Second, discretionary ministerial authority to shift protected area boundaries poses a risk of abuse For example, protected areas may be decommissioned to make way for development rather than to

[276] Dep't of Environmental Affairs and Tourism of South Africa, State of the Environment-South Africa: Terrestrial Ecosystems: Impact part 2 (1999), *available at* http://www.grida.no/publications/vg/africa/page/3120.aspx.

[277] G.P. VON MALTITZ ET AL., ADAPTING CONSERVATION STRATEGIES TO ACCOMMODATE IMPACTS OF CLIMATE CHANGE IN SOUTHERN AFRICA, S. Africa AIACC Working Paper No. 35, at 11-12 (2006).

establish new, more climate resilient areas elsewhere.[278] Any proposals to adopt such a scheme would require significant transparency in the process of selecting sites and the ability of stakeholders and authorities to detect and halt fraud and abuse.

One method of achieving some flexibility is to provide for the creation of temporary protected areas in anticipation of establishing more permanent ones. Madagascar's regulations on establishing protected areas authorize temporary protected areas to avoid resource degradation during the lengthy administrative process for permanently creating a new area.[279] Such authorities could be reinterpreted or adapted to allow for creation of temporary reserves or special 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. Of course, due consideration for land rights or tenure in this process is essential. Good experiences have also been made with temporary protected areas (zakazniks) when they were introduced in the Soviet Union to protect critical habitat of migratory species such as the Saiga Antelope (*Saiga tatarica)* during critical reproductive phases (during the rut and calving seasons). Such measures could also be useful in adapting to climate change, not only for migratory species.[280]

12.2 Improving Connectivity between Protected Areas

Key Point: Improved connectivity between core protected areas will allow species to shift their ranges in response to future climate conditions. Effective mechanisms to improve this connectivity combine land use controls with partnership opportunities, engagement with communities and stakeholders, revenue sharing, and other incentives for landowners to participate voluntarily in conservation efforts.

Policymakers can design protected areas networks to provide as many species as possible the ability to shift their ranges to lands that will be more suitable for them under future climate conditions.[281] Connectivity between protected habitats is generally improved through the use of (1) corridors, (2) stepping stones, and (3) buffer zones.[282]

---

[278] *See, e.g., Uganda: Govt to Give Away Nine More Forests*, July 16, 2007, http://www.illegal-logging.info/item_single.php?it_id=1896&it=news (last visited Dec. 17, 2009) (quoting official claiming Uganda's forest law permits decommissioning of forests at the request of local communities for land development).

[279] Decree no. 2005-848 art. 14 (2005) (Madagascar).

[280] *See* Gordon, I.J, Hester, A.J., Festa-Bianchet, M., "The management of wild large herbivores to meet economic, conservation and environmental objectives," *J. Appl. Ecol.* 41: 1021-1031 (2004).

[281] Secretariat of the Convention on Biological Diversity, Making Protected Areas Relevant: A Guide to Integrating Protected Areas into Wider Landscapes, Seascapes, and Sectoral Plans and Strategies, CBD Technical Series No. 44, Appendix 12, at 85 (2010).

[282] Ad hoc Technical Expert Group on Biological Diversity and Climate Change, Interlinkages between Biological Diversity and Climate Change: Advice on Integration of Biodiversity Consideration into Implementation of the United Nations Framework Convention on Climate Change and its Kyoto Protocol, CBD Technical Series No. 10, at 77, 82 (October 2003).

- **Corridors:** Corridors provide routes for species movement between core habitat areas. They may be formally protected and publicly owned, or, often times, they may go across private lands protected through partnerships with or incentives provided to the property owner.[283] For climate change, corridors are essential to allow species to migrate and establish new ranges when prior habitat areas are made unsuitable.[284]
- **Stepping Stones:** These serve the same function as corridors, but take the form of "islands" of suitable habitat that span an unsuitable landscape, "connecting" two or more protected areas. Because they require less land, stepping stones may be desirable for conserving species that are highly mobile, such as many birds, or that disperse widely and easily, such as plants that use airborne seed dispersion strategies.[285]
- **Buffer Zones:** Buffer zones are areas adjacent to protected habitat that serve two functions. Not only do buffer zones protect the habitat from encroachment from outside dangers, but when they are managed to allow species to shift into them, they provide a valuable function for climate adaptation..[286]

These mechanisms will need to be designed within a legal framework of land tenure and water rights, zoning and planning requirements, rules governing expropriation, and other laws. Governments can also use laws authorizing private lands conservation to strategically target conservation in such areas. Connectivity mechanisms can be integrated into resource management laws in a number of sectors. When changing or drafting these laws or requirements to facilitate connectivity between protected areas, practitioners should consider the following factors:

- Existing land ownership, use, and planning laws that may conflict with or may be used to help connect protected areas (e.g., zoning requirements to maintain green space)
- Existing aquaculture, agriculture, and forestry laws and regulations that may affect how protected areas can be connected (e.g., requirements to leave riparian zones along streams and rivers)
- Restrictive effects of land categorization on habitat connectivity (e.g., ensuring commercial development zones do not fragment key habitat areas)
- The potential for using existing frameworks for national protected areas for system level planning that includes consideration of connectivity between areas

[283] NIGEL DUDLEY, IUCN, GUIDELINES FOR APPLYING PROTECTED AREA MANAGEMENT CATEGORIES 37 (2008).
[284] *See* James Sanderson et al., *Escaping the Minimalist Trap: Design and Implementation of Large-Scale Biodiversity Corridors, in* CONNECTIVITY CONSERVATION 627 (Kevin. R. Crooks and M. Sanjayan eds. 2006).
[285] Reed F. Noss, *Beyond Kyoto: Forest Management in a Time of Rapid Climate Change*, 15 CONSERVATION BIO. 578, 584 (2001); N.M. Haddad, *Finding the Corridor More Traveled*, 105 PROC. NAT'L ACAD. SCI. 19,569 (2008); ALISON CAMPBELL ET AL., UNEP WORLD CONSERVATION MONITORING CENTRE, THE LINKAGES BETWEEN BIODIVERSITY AND CLIMATE CHANGE MITIGATION 34 (2008).
[286] Sanderson et al., *supra* note X, at 628; J.J. HOPKINS ET AL., CONSERVING BIODIVERSITY IN A CHANGING CLIMATE: GUIDANCE ON BUILDING CAPACITY TO ADAPT 12 (2007).

- Ensuring resource users and communities have a right to participate in or make decisions related to connectivity, including both rights and responsibilities
- Ensuring that legal authorities to create connectivity between protected areas integrate community needs, such as poverty reduction, socio-economic development, and financial incentives, into the planning

Example: Under Peru's law governing conservation easements, a provision to give priority to private conservation areas located within buffer zones around or within public protected areas could be used to strategically direct the formation of conservation areas along biological corridors where species are expected to migrate or resettle as a result of climate change.[287] (See more on private areas conservation in Chapter 13.)

12.3 Aligning Community Roles and Benefit Sharing with Adaptation

Key Point: It is possible to both conserve ecosystems and support local communities that depend on resources from those ecosystems. Climate change makes this approach a necessity because much larger areas of land and water must be sustainably managed to support the movement and dispersal of species, and it is neither possible nor desirable to remove human settlements from all areas where habitat conservation is needed.

If the size of areas under management for conservation needs to grow to give ecosystems the best chance to adapt to climate change, this should not happen at the expense of communities, indigenous groups or other already vulnerable populations, who are frequently impoverished or rely on local resources and ecosystem services for livelihoods. These communities are already highly vulnerable to climate change, and establishing new protected areas without regard to their welfare is not acceptable conservation policy.[288] Historically, preserves, refuges, and similar protected areas in the developing world have often been set aside without sufficient recognition of or provision for indigenous peoples' aboriginal and other legal rights to continue to gather, fish, and hunt within these areas.[289] Many policymakers and conservationists now understand it is essential to provide for these rights, develop co-managed or wholly community managed protected areas, and share revenues and other benefits, recognizing that the interests of all involved are often compatible.[290] (See Chapter 11 for information on adaptation in community based natural resources management.)

Key legal and policy questions for community engagement in protected areas include:

---

[287] ENVTL. L. INST., LEGAL TOOLS AND INCENTIVES FOR PRIVATE LANDS CONSERVATION IN LATIN AMERICA: BUILDING MODELS FOR SUCCESS 169 (2003).
[288] *See* Mark Dowie, *Conservation Refugees: When Protecting Nature Means Kicking People Out*, *in* THE FUTURE OF NATURE: WRITING ON A HUMAN ECOLOGY 65 (Barry Lopez ed. 2007).
[289] For a history of expropriative conservation in Tanzania, for example, see Greg Goldstein, Note, *The Legal System and Wildlife Conservation: History and the Law's Effect on Indigenous People and Community Conservation in Tanzania*, 17 GEO. INT'L ENVTL. L. REV. 481 (2005).
[290] Secretariat of the Convention on Biological Diversity, Making Protected Areas Relevant, *supra* note X, at 29-31. *See id.* appendix 9 for a chart of protected-area governance categories.

- **Management responsibility and functions:** Are local communities given management responsibility?
- **Management accountability:** Do communities have a role in determining the outcome of management decisions?
- **Negotiation to determine management roles:** Is there a process for negotiation between government authorities and communities?
- **Benefit sharing:** Do communities have a right to share economic benefits of a protected area, either in cash (such as entrance fee revenues) or in-kind (such as use of timber), ?
- **Rights to access resources:** Do communities retain rights to access natural resources in protected areas or in any zone of them? May communities access rights directly or as a benefit in exchange for management functions?
- **Agreement/contract setting out terms and conditions:** Does the law or regulation provide for a formal agreement between government authorities and communities for protected areas management, benefit-sharing and access rights?[291]

Example: In Madagascar, local communities are given both responsibilities and incentives to actively participate in the management of local protected areas. Madagascar's protected areas management policy is to dedicate exactly half of park revenues to promote the development of local communities around the park.[292] Giving the local community a direct financial stake in the park's success helps prevent poaching, illegal logging, and other activities that reduce ecosystem resilience.

[291] *See* Tran Thi Huong Trang, Review of the Regulatory Framework Governing Community Management of Protected Areas (PAs) in Vietnam 8-9 (2007, unpublished; on file with ELI).
[292] SOURCE FROM LALAINA

High-priority conservation zones in Madagascar where Conservation International is partnering with local communities.[293]

12.4 Creating Transboundary and International Protected Areas Networks

Key Point: Management strategies that cross political borders are needed to identify, monitor, and jointly manage species and habitats vulnerable to climate change.[294]

Climate resilient biodiversity corridors will often need to cross international or other political boundaries. New efforts to "make protected areas relevant" now focus on creating systems of protected areas large enough to accommodate species range shifts in response to climate change.[295] International networks are currently being developed in the Albertine Rift, the Andes, the Apennines, the Austrian Alps, the Rocky Mountains, the Western Ghats, the Caribbean, and elsewhere.[296]

---

[293] Conservation Int'l, Harnessing Nature as a Solution to Climate Change in Madagascar 3 (Dec. 2008).
[294] Lee Hannah et al., *Conservation of Biology in a Changing Climate*, 16 CONSERVATION BIO. 264, 267 (2002).
[295] Secretariat of the Convention on Biological Diversity, Making Protected Areas Relevant: A Guide to Integrating Protected Areas into Wider Landscapes, Seascapes, and Sectoral Plans and Strategies, CBD Technical Series No. 44 (2010).
[296] Martin F. Price and Graham R. Neville, *Designing Strategies to Increase the Resilience of Alpine/Montane Systems to Climate Change*, *in* BUYING TIME: A USERS' MANUAL FOR BUILDING

Box. The Major International Conventions on Protected Areas
Policymakers may wish to assess current programs and other efforts taking place at the international level as a starting point for transboundary initiatives.[297] Some of these efforts include:

- The Convention on Migratory Species (CMS) and its daughter agreements, such as the African-Eurasian Waterbirds Agreement.
- UNESCO World Network of Biosphere Reserves (WNBR)
- The World Heritage Convention (WHC)
- UNESCO Man and the Biosphere Program
- Convention on Biological Diversity's Program of Work on Protected Areas (PoWPA)

End Box

Joint transboundary management of protected areas facilitates adaptive measures for climate change by providing a framework within which information about local changes can be conveyed to other conservation planners. Equity issues may arise in partnerships between countries with markedly different capacities to adapt to climate change.[298] A strong legal framework for international collaboration on transboundary protected areas might include:

- Methods of inspection, verification, and reporting
- Mechanisms for compliance and enforcement of commitments
- Dispute resolution processes
- Financing agreements (especially between countries with significant differences in management capacity)

Another concern is minimizing disturbance of human livelihoods in transboundary areas. Several transboundary parks have been criticized for excluding local stakeholders from decision making processes and forcing the relocation of residents.[299] An alternative model to the transboundary park system is the Transfrontier Conservation Area (TFCA). TFCAs are managed areas that cut across the border between two or more countries. They encompass one or more protected areas surrounded by community- or individually-owned land that is managed for sustainable use of natural resources. TFCAs have the potential to bring multiple simultaneous benefits. They extend the model of community based natural resource management across national boundaries, particularly in situations

---

RESISTANCE AND RESILIENCE TO CLIMATE CHANGE IN NATURAL SYSTEMS 73, 82 (Lara Hansen et al., 2003).

[297] A database of international obligations on protected areas is at UNEP & IUCN, tematea, Protected Areas, http://www.tematea.org/?q=node/6618 (last visited August 6, 2010). *See also* Arie Trouborst, *International Nature Conservation Law and the Adaptation of Biodiversity to Climate Change: A Mismatch*, 21 J. ENVTL. L. 419 (2009).

[298] Lee Hannah et al., *Protected Area Needs in a Changing Climate*, 5 FRONT ECOL. ENVT. 131, 137 (2007).

[299] Simon M. Munthali, *Transfrontier Conservation Areas: Integrating Biodiversity and Poverty Alleviation in Southern Africa*, 31 NAT. RESOURCES FORUM 51, 54-55 (2007).

where a local community or ethnic group is situated on both sides of an international border. TFCAs can also improve connectivity, open economic opportunities through tourism, decrease cultural isolation, and lay the groundwork for further regional cooperation.

Example: The *Protocol on Conservation and Sustainable Use of Biological and Landscape Diversity* signed between the Carpathian countries in Eastern Europe in 2003 is a model for regional cooperation in building a resilient protected areas network.[300] This agreement calls on the parties to, among other things, "harmonise and coordinate their efforts and cooperate on [protecting] habitats, and securing their continuity and connectivity."[301] These efforts at coordination include "establishing an ecological network in the Carpathians, composed of protected areas and other areas significant for biological and landscape diversity;"[302] "facilitat[ing] cooperation under the Carpathian Network of Protected Areas" (established by the Conference of the Parties); [303] enhancing "conservation … in areas outside of protected areas …, improving and ensuring connectivity between existing protected areas and other areas and habitats significant for … diversity"[304]; "encourag[ing] the expansion of existing transboundary protected areas or creation of new transboundary protected areas"[305]; and cooperating in the development of joint management plans, monitoring activities, scientific research, and exchange of information.[306] Each of these areas of cooperation will contribute to a stronger, more resilient protected areas network in the Carpathians. However, two areas of concern about the Protocol include the fact that the impacts of climate change are nowhere explicitly mentioned and that the role and rights of local communities are not clearly delineated.

Slovakia's Tatra National Park in the Carpathians.[307]

[300] Protocol on Conservation and Sustainable Use of Biological and Landscape Diversity to the Framework Convention on the Protection and Sustainable Development of the Carpathians done in Kiev on 22 May 2003 (signed June 19, 2008).
[301] *Id.* art. 1(1).
[302] *Id.* art. 9(3).
[303] *Id.* art 14(1).
[304] *Id.* art. 15(2).
[305] *Id.* art. 16(2).
[306] *Id.* arts. 17, 18, & 19.
[307] FAO, The Legal Framework for Sustainable Mountain Management: An Overview of Mountain-specific Instruments (2002), *available at* http://www.fao.org/docrep/004/y3549e/y3549e14.htm.

Case Study: The Mesoamerican Biological Corridor[308]

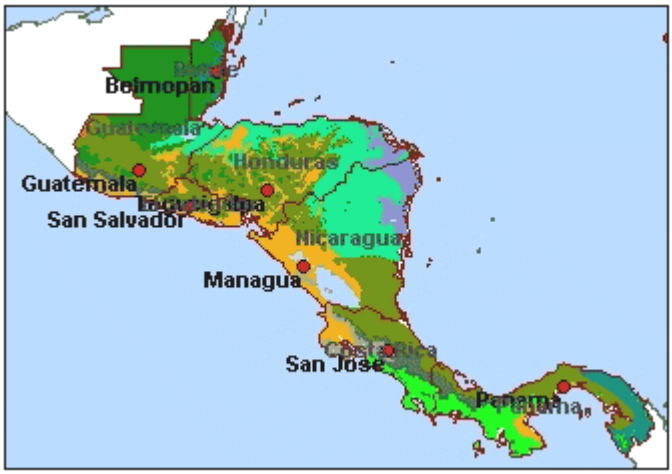


Figure 1: Areas in olive green make up the Mesoamerican Biological Corridor (Graham, Global Transboundary Protected Areas Network)

By the 1990s, the rate of deforestation in Central America and Mexico was on track for the region to lose almost all its forests within a decade and a half. In response, the affected countries established the Mesoamerican Biological Corridor (MBC) with funding from the Global Environment Facility, support from a large number of partners, and coordination by the Central American Commission on Environment and Development. Implemented individually by each nation, the aim of the MBC is to combat forest conversion, recover lost forestland, protect biodiversity, and stimulate sustainable development for local people.

To achieve these goals, the project set out to strengthen existing protected areas, link them to each other, and encourage environmentally friendly economic activities, such as organic food production, ecotourism, pharmaceutical prospecting, and reforestation. The project built upon preexisting regional and national initiatives in an effort to include all national stakeholders and harmonize regional policies. Spanning 768,990 km^2 from Mexico to Panama and covering 8% of the world's biodiversity, the MBC is a super-corridor encompassing smaller, preexisting corridors.

If successful at linking protected areas, the sheer size of the MBC is likely to provide climate adaptation benefits for the biodiversity within its borders. However, the project was not originally conceived to deal with the impacts of climate change, so its long-term utility in addressing shifting species ranges and land use is unclear. Additionally, while the project has been well received by local communities, its social and economic impact remains limited, and deforestation pressures continue. **END BOX**

12.5 Translocating Species: Legal and Policy Considerations

[308] DOUGLAS GRAHAM, GLOBAL TRANSBOUNDARY PROTECTED AREAS NETWORK, MESOAMERICAN BIOLOGICAL CORRIDOR: MEXICO TO PANAMA (2007), *available at* http://www.tbpa.net/docs/pdfs/Meso_American_Biological_Corridor.pdf.

Key Point: Translocation (also called "assisted migration") can be used to move species into habitat more suitable for future climate conditions. This should only be done with caution and with safeguards to prevent irreversible damage to the host ecosystem. Frameworks for assessment, authorization, monitoring, review, and mitigation are essential to ensure that translocations are done appropriately.

Scientists anticipate that many species will attempt to move as climate change begins to impact their current habitat.[309] But species' movements face obstacles: human infrastructure, other physical barriers, or too slow a pace of reproduction. If a species is unable to shift its range or adapt to climate change in its current location, human intervention could be the only method to prevent it from being completely eliminated in that area.[310] Conservationists are increasingly considering transporting species to new locations to protect them from climate change. This is a highly controversial technique. Proponents believe it may be the only means of saving some threatened and endangered species from climate change, while opponents see it as unproven and expensive, a drain on resources for ecosystem based conservation, and a threat to the host ecosystems where non-native species are moved because they pose a risk of becoming invasive.[311]

Few countries have adequate legal frameworks for translocation. Existing biosafety, pest-control, and general wildlife laws often impose some restrictions on intentional, non-native species introductions.[312] Other laws may allow the possibility of non-native species introductions with conditions or may prohibit their entry, depending on the circumstances.[313] But these laws do not generally contemplate the ecological benefits of intentionally introducing a species to a new area in order to prevent its annihilation in its changed environment. In one Kenyan legal case, the translocation of the rare and endangered *hirola* antelope to a protected area was halted on the basis 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

[309] G.P. VON MALTITZ ET AL., ADAPTING CONSERVATION STRATEGIES TO ACCOMMODATE IMPACTS OF CLIMATE CHANGE IN SOUTHERN AFRICA, S. Africa AIACC Working Paper No. 35, at 3-4 (2006).
[310] *See* Brian G. Keel, *Assisted Migration as a Conservation Strategy for Rapid Climate Change: Investigating Extended Photoperiod and Mycobiont Distributions for* Habenaria repens *Nutall (Orchidaceae) as a Case Study* 5 (dissertation submitted Antioch Univ. 2007), *available at* http://www.torreyaguardians.org/keel-assisted-mig-a.pdf.
[311] Bob Holmes, *Assisted Migration: Helping Nature to Relocate*, 196 NEW SCI. 46 (2007); Mark Schwartz, *Conservationists Should Not Move* Torreya taxifolia, Wild Earth (January 2005), *available at* http://www.torreyaguardians.org/schwartz.pdf.
[312] *See, e.g.*, Plant Protection Act § 3 (1937) (Uganda) (power to make rules for the prevention or spread of pests).
[313] *See, e.g.*, Plant Quarantine Act § 5 (1993) (Bhutan) ("The Royal Government instead of absolutely prohibiting the importation of any plant, pest, plant product, goods or soil may prescribe the conditions under which the import shall be permitted.").

habitat.[314] The assumption that a species can be successfully conserved in its "natural state" is doubtful if climate change renders its current habitat unsuitable.[315]

Box. The Contested Terminology of Moving Species

The technique of moving species to new locations to protect them from climate change is frequently called "assisted migration," but this term can cause confusion. The word "assistance" contains the assumption that humans *should* help species move to new areas when they are not otherwise able to move themselves. Many ecologists are concerned such movements may threaten the integrity of the host ecosystem. The terms "range shift" and "translocation" may be more precise, and are used in this section.

- **Range shifts**: This is a more inclusive term than "migration" and can be applied to the gradual movement of all life forms, including vegetation and other seemingly stationary species, in response to climate change.
- **Translocation**: The human aided transport of individuals of a species from one location to establish a viable population in another. This term follows IUCN-published guidelines.[316] **End box.**

Those considering a translocation project should undertake a thorough assessment of the ecological benefits and costs.[317] IUCN recommends considering a wide set of ecological issues before intentionally introducing a species into a new area.[318] The risks of a biological invasion should be assessed "on a site-by-site basis against the vulnerability of native populations to climate change, and the necessity and feasibility of migration to other habitats… [T]he risks of invasion may be so severe that allowing one sensitive species to be lost would be preferable to endangering the entire community."[319]

IUCN recommends using existing institutions governing natural resources to control intentional introductions of organisms, while also establishing new institutions and authorities to carry out beneficial translocations. Specific recommendations for developing translocation policies include:

- Subject all intentional species introductions to a permit system

---

[314] *Abdikadir Sheikh Hassan et al. v. Kenya Wildlife Service*, Civil Case No. 2959 (High Court of Kenya at Nairobi 1996) (emphasis in original). The injunction was later lifted, and the translocation went forward.

[315] *See* Alejandro E. Camacho, *Assisted Migration: Redefining Nature and Natural Resource Law under Climate Change*, 27 YALE J. REG. 171, 176 (2010) ("[A]ssisted migration is controversial because it challenges foundational tenets of conservation law and ethics that seek to preserve and restore preexisting biological systems and shield them from human interference.")

[316] IUCN, POSITION STATEMENT ON TRANSLOCATION OF LIVING ORGANISMS: INTRODUCTIONS, REINTRODUCTIONS AND RESTOCKING 3 (1987), *available at* http://www.iucnsscrsg.org/download/IUCNPositionStatement.pdf.

[317] J.S. McLachlan et al., *A Framework for Debate of Assisted Migration in an Era of Climate Change*. 21 CONSERVATION BIO. 299 (2007).

[318] IUCN, POSITION STATEMENT ON TRANSLOCATION OF LIVING ORGANISMS: INTRODUCTIONS, REINTRODUCTIONS AND RESTOCKING 4 (1987); *see also* J.S. McLachlan et al., *A Framework for Debate of Assisted Migration in an Era of Climate Change*. 21 CONSERVATION BIO. 299, 300-01 (2007).

[319] Stacey Combes, *Protecting Freshwater Ecosystems in the Face of Global Climate Change, in* BUYING TIME: A USERS' MANUAL FOR BUILDING RESISTANCE AND RESILIENCE TO CLIMATE CHANGE IN NATURAL SYSTEMS 177, 199-200 (Lara Hansen et al., 2003).

- Impose penalties for violations or negligence that could result in the escape or introduction of a species harmful to the environment, including criminal penalties or civil liability for damages to resources or ecosystems and attendant eradication and restoration costs
- Formulate new policies on translocation of wild species for climate adaptation
- Establish specialized authorities composed of experts to advise on policy matters related to translocation and to make recommendations on specific cases of translocation when these are proposed[320]

Caption: The Torreya Guardians, a U.S. NGO, are currently implementing a translocation project for *Torreya taxifolia*, a coniferous tree existing in small pockets at the edge of its climatic range in the state of Florida. The Guardians are relocating torreya seedlings to cooler, wetter habitat believed to have been within the torreya's historical range prior to the last glacial period.[321] This torreya seedling was translocated 600 kilometers north of existing habitat.[322] Advocates argue the U.S. Fish & Wildlife Service should define "native habitat" for purposes of endangered species restoration by reference to deep historical baselines going back to the last ice age.[323] **End Caption**

[320] IUCN, *supra* note X, at 11.
[321] Torreya Guardians, Efforts to Save *Torreya taxifolia*, http://www.torreyaguardians.org/save.html (last visited Nov. 25, 2009).
[322] http://www.torreyaguardians.org/waynesville-rewilding.html.
[323] Letter from Connie Barlow to Jessica Hellmann et al. regarding "Assisted Migration and the USF&WS management plans for endangered species" (May 13, 2010), *available at* http://www.torreyaguardians.org/barlow-leopoldreport.pdf.

Chapter 13 Private Lands Conservation

Private lands conservation is still growing as a tool for conservation in much of the developing world. The expansion of Western systems of land registration and private ownership of property pose policy challenges with respect to community rights and land tenure that cannot be addressed here. However, they also provide opportunities for private conservation efforts. This is especially important for climate adaptation efforts for biodiversity. Climate change requires management efforts to go beyond core protected areas to include non-public lands in order to facilitate species range shifts and reduce habitat fragmentation. Engaging private landowners is essential to increasing habitat connectivity over the whole landscape. Further, many landowners are responsible biodiversity stewards who understand their ecosystem and will voluntarily participate in projects to adapt to climate change.

Private conservation efforts utilize a variety of legal tools. These may include:

- Land ownership by NGOs
- Formally declared private reserves
- Ecological easements created under the civil code or by common law
- Independent or "in gross" conservation easements that benefit the public good
- The right of usufructo or comodato (i.e., the right to continue using areas in a way that is compatible with conservation objectives)
- Land donations to government protected area systems
- Conditional gifts or bequests
- Land trusts and limited development efforts
- Transfer of urban development rights
- Informal private reserves[324]

This chapter will look at how private initiatives and public laws that operate on private lands can contribute to building networks of protected areas that are resilient in the face of climate change. It will also explore options for making these devices themselves more resilient to climate change.

13.1 Private Conservation Planning for Climate Impacts

Key Point: Laws governing private conservation areas can be used for climate adaptation. This requires analysis of adaptation potential in contract law, real property law, land tenure and registration, and estates, wills, and trusts. New laws may be necessary to provide regulatory clarity.

Climate change presents special challenges that must be considered in order to ensure long-term biodiversity protection through private conservation efforts. Such easements are generally established through private agreements between a grantor (the land owner) and a grantee (a land trust or government charged with managing the easement). They

[324] ENVTL. L. INST., LEGAL TOOLS AND INCENTIVES FOR PRIVATE LANDS CONSERVATION IN LATIN AMERICA: BUILDING MODELS FOR SUCCESS 14 (2003).

may also be the result of a public-private partnership. As a first step, countries that wish to encourage private conservation areas will need to determine whether there are legal hurdles to their development, such as the restrictions that existed until recently in Latin America requiring owners to make "socio-economic use of the land."[325] Even where no direct hurdles exist, legislation authorizing their creation can provide needed regulatory clarity. Private conservation areas were non-existent, for example, in Peru until it passed the Law on National Protected Areas of 2001 (authorizing the creation of private reserves and conservation concessions). Since then, two large, private conservation areas have been established: the 34,000 hectare Private Conservation Area formed by the Chongoyape campesino community (protecting the Tumbesian forest ecosystems), and the 132,832 hectare Los Amigos watershed conservation area in the Peruvian Amazon.[326]

Caption: The Los Amigos watershed Conservation Concession.[327]

13.2 Public Law Tools to Support Adaptation and Conservation on Private Lands

Key Point: Private lands can be used strategically to augment and advance the adaptation objectives of conservation efforts on public lands and waters.

Under many climate scenarios, species previously located within a protected area may migrate into regions beyond that area's boundaries. Climate change also means that some private lands (such as land in flood plains) will no longer be suitable for commercial or residential development, and may be best used as wetlands habitat or as a buffer from flooding. Private law tools and public-private partnerships can enhance public efforts to protect biodiversity in these circumstances and others. The following options may be considered:

Protections for buffer zones and private inholdings (privately owned land within the boundaries of public lands): Negotiating the formation of private conservation areas in the buffer zones around the core protected area of a park or refuge can effectively extend

[325] *Id.* at 12.
[326] *Id.* at 167. For model legislation, see *id.* at 185.
[327] Photo: Amazon Conservation Association, Conservation Concessions, http://amazonconservation.org/ourwork/conservation.html (last visited August 19, 2010).

the protected space without requiring the formation of entirely new government controlled areas.[328]

Linking public protected areas by a network of conservation easement biological corridors: Conservation corridors are essential for allowing species movement over a wider geography than single, isolated protected areas. In Bhutan, for example, protected areas are connected by twelve biological corridors covering nine percent of Bhutan's land area. Bhutan's Nature Conservation Division (NCD) has consolidated these areas into "a macro-level natural landscape called the 'Bhutan Biological Conservation Complex,'" (B2C2).[329] Although the locations of these corridors were chosen in part to minimize disturbance of areas of human settlement and activity, they nonetheless include large areas of private or community controlled land. Bhutan established rules for designating and managing corridors under the Rules on Biological Corridors (RBC), 2007, as an addendum to the general forestry regulations promulgated in 2006. Biological corridors established by the RBC are managed in a status lower than that of "protected areas," but higher than "government reserved forests."[330] Bhutan's Ministry of Agriculture has authority to declare corridors, while the Department of Forestry is authorized to develop regulations for their management.[331] Bhutan's efforts demonstrate that it is possible to use private lands to construct corridors connecting areas, so long as attention is given to the special status of those lands. Private conservation easements may be similarly linked through the coordinated efforts of multiple landowners and the government. Incentives such as tax breaks for setting aside property for this purpose will substantially increase participation.

Community-NGO Partnerships: Conservation NGOs may have greater flexibility, adaptability, and freedom to respond to changing conditions in the management of areas under their control than the government. Moreover, they can also effectively partner with local communities. For example, in exchange for participation in effective conservation along biodiversity corridors in Madagascar, Conservation International is offering local villages a range of development benefits such as technical support for agriculture, income generating activities, infrastructure improvements, education, ecotourism development, and health services.[332] By relying on conservation groups, land trusts, and other private actors to manage conservation areas in coordination with local communities, governments can achieve three complementary policy goals: 1) lessened financial burdens on government; 2) improved adaptability in conservation area management through lower bureaucratic hurdles; and 3) community development.

Land Swaps to Create Climate Resilient PublicLands Networks: Land swapping is a familiar tool in resources law. However, regulatory authority to swap public lands for private lands has often suffered from lack of legal clarity on its purposes and the

[328] ELI, *supra* note X, at 4-5.
[329] Bhutan's Fourth National Report to the CBD (2009).
[330] Executive Order on Management of Biological Corridors in Bhutan.
[331] Regulation on Biological Corridors art. 113.
[332] CONSERVATION INT'L, HARNESSING NATURE AS A SOLUTION TO CLIMATE CHANGE IN MADAGASCAR 7 (DEC. 2008).

conditions governing when it should be done.[333] New laws and regulations can guide public managers to swap lands in cases where the newly acquired lands enhance the adaptation value of the public land network (for example, by creating a corridor on which a rare or endangered species will be able to migrate in response to climate change).[334]

Debt-for-Land Swaps: Similarly, a private person or business may be in debt to a government, or face substantial civil or administrative penalties (e.g., in the case of a business facing fines for environmental violations). In settlement negotiations with the individual or business, the government could arrange to acquire new lands for protected areas in exchange for the discharge of the debt or liability. This has been done between governments in the case of international debt,[335] but these opportunities need further exploration in the case of private persons or businesses.

Use of Royalties to Support Conservation Areas: Leaseholders for resource extraction on government lands (such as minerals, oil and gas, timber, etc.), often provide a share of profits to the government in the form of royalties. Governments can establish funds using a share of these royalties to support conservation efforts, such as the Land and Water Conservation Fund supported by royalties from offshore drilling in the United States.[336]

In-kind Royalties in the form of Landholdings: The U.S. government has experimented in recent years with use of 'in-kind' (i.e., non-monetary) forms of payment of royalties on federal oil and gas leases. A major concern is ensuring the in-kind payment is equal to the value of the lost payment and is in the public interest.[337] Policymakers may wish to explore this option to have royalty payments (or a percentage of the payment) on government leases made through an 'in-kind' form, such as the donation of land holdings or voluntary cancellation of non-productive leases. Policymakers will need to consider whether the proposed in-kind royalty payment is equal in value to monetary payments and actually has climate adaptation value for habitat conservation.

The options listed above are only a few possible mechanisms for enhancing public biodiversity adaptation programs through private law arrangements or private-public collaborations. Other types of private methods, such as increased insurance premiums or

---

[333] *See, e.g.*, Susan Jane M. Brown, *David and Goliath: Reformulating the Definition of 'The Public Interest' and the Future of Land Swaps after the Interstate 90 Land Exchange*, J. ENVTL. L. & LITIG. 235 (2000).

[334] *See* Edward J. Heisel, *Biodiversity and Federal Land Ownership: Mapping a Strategy for the Future*, 25 ECOL. L.Q. 229, 302-308 (1998).

[335] *See* Amanda Lewis, *The Evolving Process of Swapping Debt for Nature*, 10 COLORADO J. INT'L ENVTL. L. & Pol'y 431 (1999); Nicolas Kublicki, *The Greening of Free Trade: NAFTA, Mexican Environmental Law, and Debt Exchanges for Mexican Environmental Infrastructure Development*, 19 COLUMBIA J. ENVTL. L. 59 (1994).

[336] *See* Land and Water Conservation Fund Act of 1965; Public Law 88-578 (codified at 16 U.S.C. §§ 4601-4 et seq.) (U.S.A.). *See also* Dave Cleaves, U.S. Forest Service, Memorandum, Engaging a Climate Ready Agency 4 (July 7, 2010) (one of twelve criteria for land purchases using the LWCF is now climate adaptation benefits).

[337] *See* U.S. GOV'T ACCOUNTABILITY OFFICE, STRATEGIC PETROLEUM RESERVE: OPTIONS TO IMPROVE THE COST-EFFECTIVENESS OF FILLING THE RESERVE, GAO-08-521T (February 2008).

use of "long-term policies" for construction in climate sensitive areas like coastlines and flood plains,[338] should certainly be explored as well.

13.3 Mechanisms for Adapting Private Conservation Areas to Climate Change

Key Point: Contracts, charters, and agreements for private conservation areas should be drafted to ensure that conservation protections continue even if climate change causes fundamental changes in an area's ecological status.

A special set of challenges for adaptation arises in the context of private legal instruments for conservation areas. Practitioners will need to be careful in drafting the language used in these legal instruments to avoid early termination of an area as a result of climate change impacts, to ensure active management and restoration of areas, to ensure that risks are shared equitably between parties, and to effectively fulfill larger conservation objectives. Some considerations in preparing these documents include:[339]

Set terms of years: Private reserve laws and private conservation agreements may require that a reserve or easement exist over a certain period of duration. For example, in Peru, private conservation areas managed by the Institute of Natural Resources (INRENA) must be for 10 years duration and are renewable.[340] Defined time periods have the benefit that they cannot be undercut by changes in climate. In order to ensure that easements are conserved beyond the first time period, however, renewal should be cheap and easy. Other provisions for termination must be evaluated closely as well. For example, in addition to limiting duration of easements to terms of 5-20 years, Costa Rican law allows for termination of a conservation easement upon transfer of ownership of the property.[341] This termination structure may frustrate larger-scale conservation strategies that rely on an extensive network of conservation easements.

Specific language to prevent early termination due to climate impacts: Some countries may impose a requirement that conservation easements terminate if it becomes "impossible or impractical" to carry out the purposes for which the easement was created.[342] Drafters may wish to include a list of specified occurrences or situations that are expressly **not** grounds for termination based on "impossibility or impracticality"

---

[338] *See* Howard Kunreuther, Risk Management and Decision Processes Center, The Wharton School of the University of Pennsylvania, Long-Term Insurance and Climate Change, Working Paper # 2009-03-13, (prepared for International Seminar at the University of Innsbruck, *Adaptation to Climate Change: The Role of Insurance*, March 6-7, 2009); ENVIRONMENTAL DEFENSE, BLOWN AWAY: HOW GLOBAL WARMING IS ERODING THE AVAILABILITY OF INSURANCE COVERAGE IN AMERICA'S COASTAL STATES (2007).
[339] Sample easement language covering each of the following topics is provided in James L. Olmstead, *Perpetuity, Latent Ancillary Rights, and Carbon Offsets in Global Warming Era Conservation Easements*, 39 ENVTL. L. REPORTER 10842, 10843-46 (2009).
[340] ENVTL. L. INST., *supra* note X, at 186.
[341] ENVTL. L. INST., *supra* note X, at 17.
[342] Nancy A. McLaughlin, *Rethinking the Perpetual Nature of Conservation Easements*, 29 HARV. ENVTL. L. REV. 421 (2005).

under the laws governing private conservation areas.[343] Agreements can specifically provide that various types of climate change impacts, such as loss of a particular species or habitat type, arrival of exotic species, or dramatic changes in precipitation, are not grounds for termination. For those private conservation easement grantees who wish to retain the right to terminate if extreme changes in the area's ecology occur, language can be used that would provide for renegotiation if pre-agreed thresholds are crossed.

Establishing standards for amending conservation easement management that are sensitive to climate change: It is important that management plans require monitoring and periodic reviews and allow for the adjustment of the plan based on changes in the biodiversity characteristics of the area caused by climate change. Conservation easement agreements often include requirements that any change in the management of the private area must be either neutral or enhance its ecological values.[344] If climate change threatens the ecological value of an area, however, those entrusted with meeting this standard may not be able to do so. For example, drought caused by climate change leads to desiccation of an evergreen forest, which is eventually destroyed by forest fire. The easement grantee determines that the forest area can only be restored with a species of tree that is more drought resistant. It may be necessary to use third-party observers or to require that scientific authorities review the management amendments to confirm that a management choice is indeed the best option under the prevailing ecological conditions.

Equitably allocating risks and responsibilities between parties for restoration and remediation when climate change becomes a *force majeure*: Private conservation agreements should identify the party or parties who will be responsible for restoration and remediation when damage is done to the ecological values of the easement. When extensive damage to a conservation area results from an external force like climate change, it may be unfair to place all burden for remediation or restoration on any one party. And if the climate impact has caused the ecosystem or natural area to cross a "tipping point," it may be impossible to restore fully the ecological community that existed up until then. In this situation, demanding that a party fully restore the area to its historic ecological state is both unfair and impossible. It may be appropriate to expressly identify severe damage to an ecosystem as a result of climate impacts as a *force majeure* or "Act of God" for which no party is liable. The next step, of course, is to provide shared responsibility to restore the ecosystem or develop a new set of conservation objectives.

Swapping easement land when climate change destroys all value in a private conservation area: Rather than simply terminate an easement that is no longer viable to protect ecological values as a result of some severe climate impact, it may be possible to make land trades. For example, the old easement property is decommissioned and sold, and the proceeds are used to purchase a new easement in an area where ecological values may still be possible to maintain in spite of the change in climatic conditions. Taking this

[343] James L. Olmstead, *Perpetuity, Latent Ancillary Rights, and Carbon Offsets in Global Warming Era Conservation Easements*, 39 Envtl. L. Reporter 10842, 10843 (2009) (citing ELIZABETH BYERS & KARIN MARCHETTI PONTE, THE CONSERVATION EASEMENT HANDBOOK (2d ed. 2005)).
[344] Nancy A. McLaughlin, *Amending Perpetual Conservation Easements: A Case Study of the Myrtle Grove Controversy*, 40 U. RICH. L. REV. 1031 (2006).

approach to private conservation areas one step further, it may be possible to create a "global warming ark"—a system of temporary protected areas on private lands that assist species migrations as necessary and then revert to non-protected status.[345] This could be useful for bird species that are already migrating further north and to higher elevations as suitable habitat shifts with climate change.[346]

13.4 Rolling Easements: Adapting Public Trust Doctrines to Climate Change

Key point: Rolling easements provide a flexible way to adapt private land uses to climate change impacts on natural resources.

Rolling easements prevent property owners along shorelines from erecting structures that hold back the sea from advancing landward, while allowing for other types of development (so long as they comply with other environmental and land use regulations). They can be created by clauses in deeds, statutory provisions, or judicial interpretations of existing legal rights such as the public trust doctrine. Though their original purpose was to ensure public access to the shoreline, they have valuable biodiversity adaptation benefits.[347] In the United States, **rolling easements** are becoming an important tool to adapt to rising sea levels.[348]

In countries where public beach access is considered a right or where the state holds sovereign ownership in submerged lands or coast lines, practitioners can investigate what steps have been taken or need to be taken to enforce that right. In common law countries, a rolling easement may be determined to exist through judicial interpretation. Generally, they can be created through legislation as well.

How they work: The boundaries of a rolling easement automatically shift inland as the sea advances, permitting wetlands and other tidal habitats to migrate inland as well. If a property owner is subject to a rolling easement, the owner must understand that the right to protect the property from the sea is limited by the state's sovereign ownership of the shifting shoreline, the right of the public to access the shore, and environmental policy considerations related to maintaining healthy coastal habitats. If the owner's house is built high enough, the owner may be able to keep using it for a time even as the tide encroaches on parts of his property and segments become public land. If, however, the water moves far enough inland to cause the easement to shift so that it includes the land on which the house sits, the property owner may be required to move the house, abandon it, agree to conditions on future occupation of the site, or even pay rent to the state to

[345] Olmstead, *supra* note X, at 10846.
[346] Nathalie Poswald et al., *Potential Impacts of Climate Change on Breeding and Non-breeding Ranges and Migration Distance of European Sylvia Warblers*, 36 J. BIOGEOGRAPHY 6 (2009).
[347] *See* U.S. Nat'l Oceanic & Atmospheric Admin., Erosion Control Easements, http://coastalmanagement.noaa.gov/initiatives/shoreline_ppr_easements.html (last visited Dec. 1, 2009).
[348] James G. Titus, *Does the U.S. Government Realize that the Sea is Rising? How to Restructure Federal Programs so that Wetlands and Beaches Survive*, 30 GOLDEN GATE U.L. REV. 717 (2000).

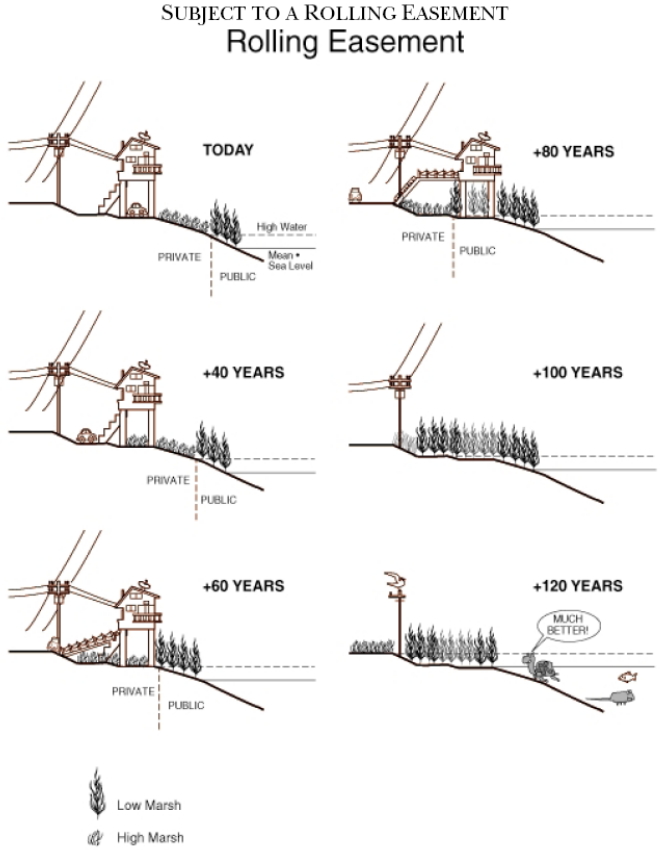
continue using it.[349] See Figure X for an illustration of how easement borders shift landward with rising sea levels.

Legal Effect of a Rolling Easement: Lessons for Adaptation

Courts in several U.S. states have affirmed the legal validity of rolling easements, and state legislatures have codified them through specific statutory provisions. Texas state courts have held that property along the Gulf of Mexico is automatically subject to a rolling easement. The courts reason that if the Gulf shores were not subject to a rolling easement, the public's guaranteed right of beach access would disappear as the shore erodes.[350] In a California case, a shoreline property owner claimed that riparian property ownership includes a "'right' to construct a revetment or seawall to protect one's dwelling from destruction." The court partially rejected this claim, holding that the state's coastal authorities could impose conditions on the construction of the seawall.[351] Legislation has also been used to create rolling easements or similar restrictions on coastal development. A Texas statute concerning public beaches directs the officials to "strictly and vigorously enforce the prohibition against encroachments on and interferences with the public beach easement." [352] Using this law, Texas courts have prevented people from repairing storm damaged houses and have required others to remove structures when erosion caused a portion of the property to be on the seaward side of the vegetation line.[353] Rhode Island's coastal management plan prohibits construction of hard structures like bulkheads or sea walls inland of coastal marshes in certain areas in order to allow wetlands to migrate inland as sea levels rise.[354]

[349] James G. Titus, *Coastal Erosion, and the Takings Clause: How to Save Wetlands and Beaches without Hurting Property Owners*, 57 Md. L. Rev. 1279, 1317 (1998).
[350] Feinman v. State, 717 S.W.2d 106, 111 (Tex. App. 1986, writ ref'd n.r.e.).
[351] Whalers' Village Club v. California Coastal Commission, 220 Cal. Rptr. 2 (Ct. App. 1985); *see also* Titus (1998), p.1374-1375.
[352] TEX. NAT. RES. CODE ANN. § 61.011(c) (West 1978 and Supp. 1998).
[353] Arrington v. Mattox, 767 S.W.2d 957, 958 (Tex. App. 1989, writ denied).
[354] Rhode Island Coastal Resource Management Program §§ 210(B)(4), 210.3(C)(3) (1993).

THE LANDWARD MIGRATION OF WETLANDS ONTO PROPERTY SUBJECT TO A ROLLING EASEMENT



A rolling easement allows construction near to the shore, but requires the property owner to recognize nature's right of way to advance inland as sea level rises. In this case, the high marsh reaches the footprint of the house 40 years hence. Because the house is on pilings, it can still be occupied (assuming that it is hooked to a sewerage treatment plant—a flooded septic system would probably fail). After 60 years, the marsh has advanced enough to require the owner to park the car along the street and construct a catwalk across the front yard. After 80 years, the marsh has taken over the entire yard; moreover, the footprint of the house is now seaward of mean high water and hence on public property. At this point, additional reinvestment in the property is unlikely, and the state might charge rent for continued occupation of the home. Twenty years later, the particular house has been removed, although other houses on the same street may still be occupied. Eventually, however, the entire area returns to nature.

Figure 2.[355]

Several concerns must be considered and addressed before introducing rolling easements into a country's system of property law. First, few developing countries have national laws that explicitly recognize the use of traditional easements for conservation purposes, much less provide legal authority for rolling easements. While some easements have been established through creative means, often there is little potential for widespread use of easements without statutory authorization.[356] Second, relatively weak judicial systems may make it especially difficult to enforce easements, and the high cost of litigation can prevent breaches of easement agreements from being resolved.[357] Third, easements

[355] Graphic from James G. Titus, *Coastal Erosion, and the Takings Clause: How to Save Wetlands and Beaches without Hurting Property Owners*, 57 Md. L. Rev. 1279, 1316 (1998).
[356] ENVTL. L. INST., *supra* note X, at 22.
[357] *Id.* at 25.

require clear land title, which is often unavailable in rural parts of developing countries where tenure is insecure or land registration systems are incomplete.[358]

New Applications: Rolling Wildlife Easements?

Rolling easements should be considered for use as a tool in pursuing other policy goals that require land use patterns to shift as ecological phenomena and other natural barriers migrate or shift under changing ecological conditions.[359] Beyond their use in sea level advancement, the rolling easement mechanism has potential application in adapting land use patterns to accommodate changes in biodiversity as a result of climate change. The legal theory is that wildlife is a public trust resource and that the government has an affirmative obligation to ensure that resource is sustainably managed for future generations.[360] Rather than adjusting to rising sea levels, a rolling wildlife easement would respond to shifts in species ranges, temperature gradients, or precipitation regimes. Detailed criteria may need to be developed to determine when a shifting ecological phenomenon requires movement of the easement boundaries. Indicators that might trigger movement of an easement could include, for example:

- Presence of an indicator species in an easement area
- Thresholds based on a percentage of a species population or its range that has moved into an easement area
- Thresholds based on percentages of forest cover (where forest is expanding into new area), or grasslands (where grasses are spreading), etc.
- Changes in precipitation patterns or other hydrological indicators based on five-year seasonal averages

A conservation manager could negotiate rolling easements with landowners that own land within bioclimatic sensitive areas. An agreement might require a landowner not to take actions that would prevent species from migrating onto his land as the climate shifts, while still allowing other types of economically beneficial use on the land. The agreement might restrict actions such as clearing land or creating barriers around agricultural plantings, both of which often break up migration routes. As the shifting climate forces species further and further onto the land, an increasing portion of it would come under the state's management. Financial support such as annual payments to landowners who participate in such programs, insurance mechanisms,[361] or reducing regulatory burdens on landowners who voluntarily participate may be important to build "buy-in" for the project.[362]

---

[358] *Id.*
[359] James G. Titus, *Coastal Erosion, and the Takings Clause: How to Save Wetlands and Beaches without Hurting Property Owners*, 57 Md. L. Rev. 1279, 1313 (1998).
[360] *See* Patrick Redmond, Note, *The Public Trust in Wildlife: Two Steps Forward, Two Steps Back*, 49 Nat. Resources J. 249 (2009).
[361] *See* Jonathan F. Tross, *Insuring against the Snail-darter: Insurance for Land Use and the Endangered Species Act*, 11 CONNECTICUT INSURANCE L. J. 471 (2005).
[362] Lee Hannah et al., *Climate Change-Integrated Conservation Strategies*, 11 GLOBAL ECOLOGY & BIOGEOGRAPHY 485, 493 (2002).

Rolling easements alone can be helpful for protecting shorelines, but they are usually most effective when used in coordination with other approaches, such as setbacks, density restrictions, and other building restrictions along the shore.[363] Similarly, rolling easements for wildlife would likely be more effective if combined with other policies that limit land use or that incentivize environmentally benign activities in other ways.

Box. Could Rolling Easements Save Sea Turtle Nesting Habitat?[364]

Leatherback sea turtles are threatened with extinction due to a combination of climate change impacts and patterns of human land use along beaches that provide critical nesting habitat. Globally, only 2,000 to 3,000 leatherbacks are estimated to be alive today. Twenty years ago their population was around 90,000. The turtles are highly sensitive to climate change. They feed on coral reefs that are now dying as oceans warm (causing bleaching of the coral and an increase in disease), and they lay eggs on beaches that are now regularly flooding due to sea level rise and storm surges. Warming sands also produce more females, and very hot sands kill the eggs altogether.

These impacts are made worse by unsustainable development patterns. For example in La Playa Grande, Costa Rica, a 50 meter stretch of beach landward of the mean high water line is publicly owned,[365] but beyond that, a strip of coastal development on a mixture of public concessions and private lands forms a man-made barrier to the coastal ecological zone. As the sea rises, nesting habitat is squeezed against the strip of hotels, vacation homes, and shops. Scientists believe a protected strip of 128 meters behind the high tide line is needed to protect the turtles, but property owners have demanded compensation that the government is unable to pay.

A rolling easement might be an effective solution to this problem. The easement would specifically need to accomplish the following:

- Set the easement boundary immediately at 128 meters landward of the high tide line, and require periodic, mandatory adjustment of this line as sea levels rise
- Prohibit property owners within the easement from undertaking repairs to properties that are damaged by storms or sea level rise
- Prohibit construction of sea walls or bulkheads to keep out rising seas
- Prohibit new construction that negatively impacts turtle nesting or prevents beach migratio;
- Allow existing property uses to continue only so long as they remain viable without additional protective measures and do not inhibit turtle nesting

This last provision is a critical element in rolling easements because it helps negate claims from landowners that they should be compensated by allowing existing

[363] U.S. Nat'l Oceanic & Atmospheric Admin., Erosion Control Easements, http://coastalmanagement.noaa.gov/initiatives/shoreline_ppr_easements.html (last visited Dec. 1, 2009).
[364] *See* Lara Hansen et al., *Designing Climate-Smart Conservation: Guidance and Case Studies*, 24 CONSERVATION BIO. 63 (2010); Elisabeth Rosenthal, *Turtles are Casualties of Warming in Costa Rica*, N.Y. TIMES, Nov. 14, 2009.
[365] ENVTL. L. INST., *supra* note X, 113, n. 142.

economically beneficial uses to continue, so long as they are ecologically viable. **End Box**