CONSERVING THE WORLD'S FORESTS: ARE PROTECTED AREAS THE ONLY WAY?

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"[W]e know less about what brings deforestation under control, except that experience suggests the need for strong government institutions to implement stated policies and resist elite groups who have traditionally pursued the exploitation of the forest."[1]

"No long-term management strategy is effective without the involvement of all stakeholders, particularly those who live in the immediately adjacent areas."[2]

I. WHY PROTECTED AREAS?

In 1992, the Earth Summit in Rio de Janeiro highlighted the environmental destruction occurring in the world and the need to protect biodiversity hotspots. Following on the tail of the Bruntland Commission report,[3] the Earth Summit called for sustainable development and greater protection of valuable ecosystems. Set in Brazil, the Earth Summit also drew attention to the plight of the world's forests as images of the Amazon aflame awakened many to the threats of rampant deforestation. As a result, 150 government leaders signed the Convention on Biological Diversity (CBD) that emerged as a major outcome of the Rio meeting.[4] As part of the CBD, the participating governments agreed to "[e]stablish a system of protected areas or areas where special measures need to be taken to conserve biological diversity."[5] In the same year, participants in the Fourth World Congress on National Parks and Protected Areas agreed to

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1. MICHAEL WILLIAMS, DEFORESTING THE EARTH: FROM PREHISTORY TO GLOBAL CRISIS 498 (2003).

2. Anthony R. E. Sinclair & Brian H. Walker, *Foreword* to THE KRUGER EXPERIENCE: ECOLOGY AND MANAGEMENT OF SAVANNA HETEROGENEITY xiii, xv (Johan T. du Toit et al. eds., 2003).

3. OUR COMMON FUTURE: THE WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT (Gro Harlem Bruntland ed., 1987).

4. Convention on Biological Diversity, *opened for signature* May 22, 1992, 1760 U.N.T.S. 79.

5. *Id*. art. 8a.

designate a minimum of 10% of each biome under their jurisdiction (oceans, forests, tundra, wetlands, grasslands) as protected areas.[6]

The establishment of protected areas to protect forest lands is largely based on a belief that government jurisdiction over forests with defined restricted uses is necessary for sustained conservation.[7] The desire to protect large territories so habitats can be connected at a large spatial scale is also a scientific reason often given as a foundation for the creation of protected areas.[8] Many of the larger reserves include a multiplicity of governance types with international donor funding used to initiate planning at a regional scale. While there is validity to the argument that preserving habitat for some species should be done at a large spatial scale, the preference articulated by many conservationists for government protection does not have as strong a foundation.

Managing protected areas has been seen by many as the preeminent method for protecting forests, wildlife, and wilderness in general.[9] Today, more than 100,000 protected areas have been launched and officially encompass roughly 10% of the world's forests.[10] During the last half century, developing countries greatly expanded the extent of their land designated as protected areas.[11] In many instances, however, the designation of a protected area on a map generated substantial donor funding, but not the creation of effective protected areas on the ground.[12] Donor projects have tended "to invest heavily in extensive background studies and elaborate plans made by outside experts, generating reports that too often are rarely used, culturally irrelevant, and quickly obsolete."[13]

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6. Krishna B. Ghimire & Michel P. Pimbert, *Social Change and Conservation: an Overview of Issues and Concepts*, *in* SOCIAL CHANGE AND CONSERVATION: ENVIRONMENTAL POLITICS AND IMPACTS OF NATIONAL PARKS AND PROTECTED AREAS 1, 11 (Krishna B. Ghimire & Michel P. Pimbert eds., 1997) [hereinafter SOCIAL CHANGE AND CONSERVATION].

7. AUGUSTA MOLNAR ET AL., FOREST TRENDS & ECOAGRICULTURAL PARTNERS, WHO CONSERVES THE WORLD'S FORESTS? COMMUNITY-DRIVEN STRATEGIES TO PROTECT FORESTS & RESPECT RIGHTS (2004).

8. Mark W. Schwartz, *Choosing the Appropriate Scale of Reserves for Conservation*, 30 ANN. REV. ECOLOGY & SYSTEMATICS 83 (1999).

9. NATIONAL PARKS, CONSERVATION, AND DEVELOPMENT: THE ROLE OF PROTECTED AREAS IN SUSTAINING SOCIETY (Jeffrey A. McNeely & Kenton R. Miller eds., 1984); P. H. C. LUCAS, PROTECTED LANDSCAPES: A GUIDE FOR POLICY-MAKERS AND PLANNERS (1992).

10. 2003 UNITED NATIONS LIST OF PROTECT AREAS vii (Stuart Chape et al., compilers, 2003), *available at* http://www.unep-wcmc.org/index.html?http://www.unep-wcmc.org/protected_areas/UN_list/~main.

11. Michael J. B. Green & James Paine, State of the World's Protected Areas at the End of the Twentieth Century, Paper presented at IUCN World Commission on Protected Areas Symposium on *Protected Areas in the 21st Century: From Islands to Networks,* Albany, Australia (Nov. 24–29, 1997).

12. Kevin Bishop et al., *Protected For Ever? Factors Shaping the Future of Protected Areas Policy*, 12 LAND USE POL'Y 291 (1995).

13. Jeffrey Sayer & Michael P. Wells, *The Pathology of Projects, in* GETTING BIODIVERSITY PROJECTS TO WORK: TOWARDS MORE EFFECTIVE CONSERVATION AND DEVELOPMENT 35, 39 (Thomas O. McShane & Michael P. Wells eds., 2004) [hereinafter GETTING BIODIVERSITY

Some conservationists continue to call for an increase in the area of forests under strict reserve management.[14] However, we actually do not know how well protected areas conserve the lands, so how can we in good conscience extend this system to the rest of the world's forests?[15] Considerable debate exists regarding the general causes of loss of biodiversity or the massive levels of deforestation that are occurring.[16] Many cases of government weaknesses in managing natural resources have been documented.[17]

In 1999, the World Conservation Union reported on the effectiveness of forest protected areas and concluded that protected areas continue to face threats from human pressures and legal designation does not ensure sustained conservation. The survey that the International Union for Conservation of Nature and Natural Resources (IUCN) conducted of protected areas in 10 key forested countries found only 1% of these protected areas were secure from threat.[18] The IUCN further noted that many protected areas lack financial and human resources, a supportive legal framework, and the institutional infrastructure necessary to regulate agriculture, grazing, forestry, mining, hunting, civil conflict, and tourism.[19]

A recent study conducted by WWF International of more than 200 protected areas in 37 countries found similar results.[20] While protected areas in these

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PROJECTS TO WORK].

14. RICHARD E. RICE ET AL., SUSTAINABLE FOREST MANAGEMENT: A REVIEW OF CONVENTIONAL WISDOM (2001); WORLD WILDLIFE FEDERATION, ARE PROTECTED AREAS WORKING? AN ANALYSIS OF FOREST PROTECTED AREAS BY WWF (2004) [hereinafter WWF], *available at* http://www.panda.org/downloads/forests/areprotectedareas working.pdf; Francis E. Putz et al., *Tropical Forest Management and Conservation of Biodiversity: An Overview*, 15 CONSERVATION BIOLOGY 7 (2001); Richard E. Rice et al., *Can Sustainable Management Save Tropical Forests*, 276 SCI. AM. 44 (1997).

15. JOHN F. OATES, MYTH AND REALITY IN THE RAIN FOREST: HOW CONSERVATION STRATEGIES ARE FAILING IN WEST AFRICA (1999).

16. ANUP SHAH, THE ECONOMICS OF THIRD WORLD NATIONAL PARKS: ISSUES OF TOURISM AND ENVIRONMENTAL MANAGEMENT (1995); Robert T. Deacon, *Assessing the Relationship between Government Policy and Deforestation*, 28 J. ENVTL. ECON. & MGMT. 1 (1995); Robert T. Deacon, *Deforestation and the Rule of Law in a Cross-Section of Countries*, 70 LAND ECON. 414 (1994); Claudia Romero & Germán I. Andrade, *International Conservation Organizations and the Fate of Local Tropical Forest Conservation Initiatives*, 18 CONSERV BIOL 578 (2004); Michael Wells, *Biodiversity Conservation, Affluence and Poverty: Mismatched Costs and Benefits and Efforts to Remedy Them*, 21 AMBIO: J. HUM. ENV'T 237 (1992).

17. WILLIAM ASCHER, WHY GOVERNMENTS WASTE NATURAL RESOURCES: POLICY FAILURES IN DEVELOPING COUNTRIES (1999); PROPERTY RIGHTS: COOPERATION, CONFLICT, AND LAW (Terry L. Anderson & Fred S. McChesney eds., 2003).

18. INT'L UNION FOR CONSERVATION OF NATURE AND NATURAL RES., THREATS TO FOREST PROTECTED AREAS: SUMMARY OF A SURVEY OF 10 COUNTRIES CARRIED OUT IN ASSOCIATION WITH THE WORLD COMMISSION ON PROTECTED AREAS 2 (1999) [hereinafter IUCN].

19. *Id.*; *see also* PARKS IN PERIL: PEOPLE, POLITICS, AND PROTECTED AREAS (Katrina Brandon et al. eds., 1998).

20. WWF, *supra* note 14.

countries are legally well established and many of the boundaries are demarcated, these formal arrangements are not sufficient to protect an area by themselves. Among the weaknesses identified by survey respondents was the effectiveness of their own protection systems.[21] Thus, they frequently failed to monitor and enforce the reserve regulations. Protected areas also consistently failed to engage in positive relations with the local residents and with indigenous peoples.[22] WWF found that four key threats endanger forest protected areas: poaching, encroachment, logging, and gathering of non-timber forest products.[23] The report also found that effectiveness of protected areas varied by region. Protected areas in Europe, for example, scored significantly higher on management effectiveness than protected areas in Latin America.

The poor results for protected areas in Latin America are environmentally important, because 60% of the world's tropical forests lie in this region.[24] Furthermore, according to Michael Jenkins, president of Forest Trends, and his colleagues, approximately 90% of the world's forests remain outside protected area systems.[25] Should the first priority be to place these forests within protected areas? Or, are there other options that should be considered? Due to the many problems encountered by protected areas that exclude local residents from any formal role in relationship to the designated areas, many analysts, donors, and environmental groups have successfully urged the creation of integrated conservation and development projects that have dual responsibilities: to protect biodiversity and to enhance the economic development of people living around a protected area. While some of these projects have succeeded in achieving aspects of both goals, many have been based on unrealistic assumptions.[26] In this Article, we present a more nuanced discussion of the advantages and disadvantages of protected areas as well as summarize several carefully designed empirical studies that cumulatively suggest that protected areas are not always necessary, and are by no means, the *only* way to conserve forests. Nor are there any other panaceas guaranteed to protect forests against loss of biodiversity, extent, or sustainability. There are, however, some successful alternatives to protected areas as well as some successful protected areas.

II. WHY LOOK ELSEWHERE?

As both the IUCN and WWF reports conclude, protected areas struggle to monitor and enforce forest regulations adequately. In addition, one of the

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21. *Id*. at 8.

22. *Id*.

23. *Id*. at 11.

24. SOCIAL CHANGE AND CONSERVATION, *supra* note 6, at 5.

25. Michael Jenkins et al., *Markets for Biodiversity Services: Potential Roles and Challenges*, ENV'T, July-Aug. 2004, at 32, 34.

26. GETTING BIODIVERSITY PROJECTS TO WORK, *supra* note 13 (an excellent overview of the puzzles and challenges of trying to accomplish both of these goals); John G. Robinson & Kent H. Redford, *Jack of All Trades, Master of None: Inherent Contradictions among ICD Approaches, in* GETTING BIODIVERSITY PROJECTS TO WORK, *supra* note 13, at 10.

greatest challenges for protected area personnel is working with local communities to mediate human pressures on ecological resources. Managing protected areas is particularly difficult when active local resistance to protected area policies is present and the protected areas have limited financial and human resources.

Unfortunately, through much of history, decisions to create government-protected areas have often been made by conservationists or colonial powers with little thought about the rights, cultural traditions, and livelihood needs of the local residents living in the ecological regions.[27] Today, many advocates continue to promote the use of protected areas irrespective of local livelihood needs, declaring that biodiversity protection is a moral imperative that can only be adequately protected through strict government regulations and that sustainable development and ecologically friendly communities are mere myths—at least in the naïve way that many integrated conservation and development programs have been funded.[28]

Inattention to the political and economic costs of protected areas, however, leads some advocates to believe that simply declaring a territory to be a protected area is sufficient for all conservation needs and ignores the challenges many of these areas face. The costs of enforcing laws that are not perceived to be legitimate by those expected to comply with the laws has repeatedly been found to be excessive. The problem of hiring guards or police, paying them well, imposing costly sanctions on those caught breaking the law, trying to ensure that guards do not use opportunities to collect bribes, and coping with widespread dissatisfaction with what is conceived as illegitimate imposition of formal laws is a general problem.[29] It is not restricted only to the protection of forests.

In her study of rates of compliance by taxpayers with government-imposed taxes, for example, Margaret Levi uses the concept of "quasi-voluntary compliance" to explain why in some countries citizens do comply with taxes at very high levels. Paying taxes in these systems is "voluntary" in the sense that many citizens choose to comply in situations where they are not being directly observed and coerced. It is not entirely voluntary, however. It is only *quasi-*

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27. SUSANNA HECHT & ALEXANDER COCKBURN, THE FATE OF THE FOREST: DEVELOPERS, DESTROYERS AND DEFENDERS OF THE AMAZON (1990); RODERICK P. NEUMANN, IMPOSING WILDERNESS: STRUGGLES OVER LIVELIHOOD AND NATURE PRESERVATION IN AFRICA (1998); SOCIAL CHANGE AND CONSERVATION, *supra* note 6; Peter R. Wilshusen et al., *Reinventing a Square Wheel: Critique of a Resurgent "Protection Paradigm" in International Biodiversity Conservation*, 15 SOC'Y & NAT. RESOURCES 17 (2002).

28. JOHN TERBORGH, REQUIEM FOR NATURE (1999); Kent H. Redford & Allyn Maclean Stearman, *Forest-Dwelling Native Amazonians and the Conservation of Biodiversity: Interests in Common or in Collision?*, 7 CONSERVATION BIOLOGY 248 (1993); Wilshusen et al., *supra* note 27.

29. JON ELSTER, THE CEMENT OF SOCIETY: A STUDY OF SOCIAL ORDER (1989); JAMES C. SCOTT, SEEING LIKE A STATE: HOW CERTAIN SCHEMES TO IMPROVE THE HUMAN CONDITION HAVE FAILED (1998); ROBERT SUGDEN, THE ECONOMICS OF RIGHTS, CO-OPERATION, AND WELFARE (1986); Antonio Azuela, *Illegal Logging and Local Democracy: Between Communitarianism and Legal Fetishism*, 19 J. SUSTAINABLE FORESTRY 81 (2004).

voluntary since "the noncompliant are subject to coercion—if they are caught."[30] It is possible to achieve a general strategy of quasi-voluntary compliance where citizens have confidence that "(1) rulers will keep their bargains and (2) the other constituents will keep theirs. Taxpayers are strategic actors who will cooperate only when they can expect others to cooperate as well. The compliance of each depends on the compliance of the others."[31] Understanding these conditions is crucial for those interested in protecting forests and other natural resources.

When protected areas are declared in some distant capital by officials who fail to consider or inform local populations, residents of the reserve may not even know a protected area exists. Furthermore, even when locals are informed of the protected status, those who have relied on the resources for their own livelihoods for long periods of time, or perceive it to be their right to exploit the natural resource system, may continue their old practices and engage in violent protests when officials are sent to enforce a law that is not perceived locally as legitimate and is not consistently enforced.

When residents do not believe that the government has the right to regulate their resource use, they will often find ways to resist or sabotage park regulations. Conflict between park residents and park personnel is well-documented and a consistent theme[32] in discussions about protected areas.[33] Examples of places where conflict exists between residents and park personnel include Khoa Yai in Thailand, where local residents resisted protected area policies implemented by the Royal Forestry Department and fighting resulted in the deaths of local residents and park personnel.[34] In Eastern Africa, the Maasai have protested protected area regulations that eliminated key watering spots and disrupted their traditional cattle herding patterns.[35] Similarly, in Costa Rica, park policies in certain regions have enraged local residents who feel that the park administration is impinging on local livelihoods.[36] And, in the Rio Plátano Biosphere Reserve in Honduras, as in other contested protected areas, park

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30. MARGARET LEVI, OF RULE AND REVENUE 52 (1988).

31. *Id*. at 53.

32. World Conservation Union, World Parks Congress Workshops (Sept. 8-17, 2003), *Building Broader Support For Protected Areas*, *at* http://www.iucn.org/themes/wcpa/wpc2003/english/programme/workshops/broader.htm.

33. MANAGING CONFLICTS IN PROTECTED AREAS (Connie Lewis ed., 1996); MOLNAR ET AL., *supra* note 7; MICHAEL WELLS & KATRINA BRANDON, PEOPLE AND PARKS: LINKING PROTECTED AREA MANAGEMENT WITH LOCAL COMMUNITIES (1992); DAVID WESTERN, IN THE DUST OF KILIMANJARO (1997).

34. WELLS & BRANDON, *supra* note 33, at 10.

35. JIM IGOE, CONSERVATION AND GLOBALIZATION: A STUDY OF NATIONAL PARKS AND INDIGENOUS COMMUNITIES FROM EAST AFRICA TO SOUTH DAKOTA (2004); WESTERN, *supra* note 33.

36. WELLS & BRANDON, *supra* note 33; Craig MacFarland et al., *Establishment, Planning and Implementation of a National Wildlands System in Costa Rica, in* NATIONAL PARKS, CONSERVATION, AND DEVELOPMENT: THE ROLE OF PROTECTED AREAS IN SUSTAINING SOCIETY 592 (Jeffrey A. McNeely & Kenton R. Miller eds., 1984).

guards frequently receive death threats and active resistance to park regulations.[37]

Protected areas in general, and contested protected areas in particular, are economically costly to monitor and enforce. Costs to manage protected areas are increasing as current global trends indicate that public expenditure and international financing are flat or declining.[38] The conservation community estimates that an additional U.S. $27 to $30 billion is needed annually to adequately manage protected areas.[39] This is particularly troubling for developing countries. The WWF report finds that adequate funds are correlated with effective protected area management. It also finds that many developing countries lack these funds. For example, the average budget per protected forest area in Europe is eight times that in Latin America.[40]

In recent years, more attention has been given to including greater local participation in protected areas in order to reduce conflict, support traditional conservation practices, and decrease monitoring and enforcement costs.[41] This is consistent with a broadening of the concept of property rights themselves.[42] Adrian Phillips, former chair of the World Commission of Protected Areas, stated that the crucial lesson in protected area management is "the iron rule that no protected area can succeed for long in the teeth of local opposition."[43] But, many protected area planners and administrators are still unable to enact participatory policies that are legitimate in the eyes of the residents.[44] As the WWF report found, many protected areas continue to struggle in their relations with local residents.

A significant gap in the analysis of forest protection is attention to other institutional mechanisms for conservation. A survey of forest management by Molnar and colleagues finds that a minimum of 370 million hectares of global forest lands are under community conservation.[45] Their work and the work of others demonstrate that public ownership is not the only institutional

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37. TANYA M. HAYES, COLLABORATIVE MANAGEMENT: AN INSTITUTIONAL ANALYSIS OF COMMUNITY-STATE COOPERATION TO CONSERVE THE RIO PLÁTANO BIOSPHERE RESERVE, HONDURAS (Ctr. for the Study of Institutions, Population, and Envtl. Change, Working Paper No. CWP-04-03, 2004); David J. Dodds, *Lobster in the Rain Forest: The Political Ecology of Miskito Wage Labor and Agricultural Deforestation*, 5 J. POL. ECOLOGY 83 (1998).

38. MOLNAR ET AL., *supra* note 7.

39. *Id.*

40. WWF, *supra* note 14, at 25.

41. Grazia Borrini-Feyerabend, *Indigenous and Local Communities and Protected Areas: Rethinking the Relationship*, 12 PARKS, No. 2, at 5 (2002), *available at* http://iucn.org/themes/wcpa/pubs/pdfs/PARKS/parks12.2.pdf; Sejal Worah, *The Challenge of Community-Based Protected Area Management*, 12 PARKS, No. 2, at 80 (2002).

42. Daniel H. Cole & Peter Z. Grossman, *The Meaning of Property Rights: Law Versus Economics?*, 78 LAND ECON. 317 (2002).

43. Borrini-Feyerabend, *supra* note 41, at 11.

44. PATRICIA S. LARSON ET AL., WWF INTEGRATED CONSERVATION AND DEVELOPMENT PROJECTS: TEN LESSONS FROM THE FIELD 1985–1996 (1998); WELLS & BRANDON, *supra* note 33; Worah, *supra* note 41.

45. MOLNAR ET AL., *supra* note 7, at 3.

arrangement that may be associated with environmental conservation.[46] The number of forests lying outside protected areas also demonstrates the need to understand what conditions have promoted their protection and thwarted their destruction. The Forest Trends study concludes that secure tenure rights, institutional and regulatory support for community institutions, fair access to markets, direct finance to local communities, and engagement of local communities in conservation research all appear to increase the probability of successful community forest conservation.[47] The findings suggest the importance of considering conservation prospects outside of legally designated protected areas.

III. CONTINUED RELIANCE ON PROTECTED AREAS: THE NEED TO CONSIDER ALTERNATIVES

Despite the apparent importance of local communities in forest conservation, many conservationists are reluctant to step outside the confines of the protected area model and explore alternative institutional arrangements for forest management.[48] For example, in their study published in *Science* on the *Effectiveness of Parks in Protecting Tropical Biodiversity*, Aaron Bruner and colleagues examine the ability of parks to mediate anthropogenic threats.[49] In the introduction to their article they reflect on the growing criticism of parks and the greater promotion of sustainable forest management and community conservation, and note the lack of empirical research that has tested how parks measure up to alternative institutional arrangements. Regrettably, Bruner and colleagues fail to compare parks to these alternatives. Instead they base their findings on a survey of park officials about the conditions inside their own parks and within a ten-kilometer boundary outside the parks. The authors find that protected areas are effective, particularly when parks are actively monitored and enforced by official guards. Relying on park officials alone to judge the effectiveness of their own park is, however, subject to considerable methodological concerns.[50] Based on these questionnaire responses, Bruner and colleagues conclude that central, law-defined, strictly protected area systems enforced by public officials are necessary. Unfortunately, they fail to consider

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46. *See, e.g.*, ELINOR OSTROM, GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION (1990); THE EQUITABLE FOREST: DIVERSITY, COMMUNITY, AND RESOURCE MANAGEMENT (Carol J. Pierce Colfer ed., 2005); Thomas Dietz et al., *The Drama of the Commons*, *in* THE DRAMA OF THE COMMONS 1, 3 (Elinor Ostrom et al. eds., National Research Council, 2002) [hereinafter THE DRAMA OF THE COMMONS]; Thomas Dietz et al., *The Struggle to Govern the Commons*, 302 SCI. 1907 (2003) [hereinafter Dietz et al., *The Struggle to Govern the Commons*]; Clark C. Gibson et al., *Explaining Deforestation: The Role of Local Institutions*, *in* PEOPLE AND FORESTS: COMMUNITIES, INSTITUTIONS, AND GOVERNANCE 1 (Clark C. Gibson et al. eds., 2000).

47. MOLNAR ET AL., *supra* note 7, at 20.

48. *See, e.g.*, TERBORGH, *supra* note 28; Aaron G. Bruner et al., *Effectiveness of Parks in Protecting Tropical Biodiversity*, 291 SCI. 125 (2001).

49. Bruner et al., *supra* note 48.

50. *See* IUCN, *supra* note 18.

the effectiveness of alternative conservation strategies.

The principal arguments given for protected areas as the only way to conserve forests are that (1) the only way to maintain forest cover is the establishment of defined areas that are owned and regulated by a national government for the purpose of preservation; (2) resource users are unable to create and enforce appropriate resource management rules; and hence (3) substantial investment in top-down enforcement is essential to achieve adequate environmental protection. Results from studies on forest management, however, suggest that these three arguments are myths that do not hold when tested with empirical evidence.

A. Empirical Studies of Diverse Forest Institutions

To examine these myths, we draw on multiple studies that colleagues associated with the Center for the Study of Institutions, Population, and Environmental Change (CIPEC) and the Workshop in Political Theory and Policy Analysis, both at Indiana University, have conducted as a result of their collaboration with an international network of scholars interested in understanding how institutions interact with biophysical and behavioral factors to influence land use and land-use change—particularly forested land. In these studies, we have measured forest conditions using multiple measures. In this Article, we report primarily on the stability of forest cover and the abundance of vegetation density. Before turning to the empirical results, however, let us briefly discuss some of the methods that we have used.

B. International Forestry Resources and Institutions Field Protocols

The International Forestry Resources and Institutions (IFRI) research and training program was initiated as a result of a request in 1992 from Dr. Marilyn Hoskins, who headed the Forestry, Trees, and People Program at the Food and Agricultural Organization (FAO) of the United Nations. Many policies were under discussion at FAO related to the best legal structure to develop and to enhance forest preservation. Dr. Hoskins asked us to develop a reliable methodology that could be implemented by research teams in developing countries working together as a network to explore the effectiveness of protected areas, community forests, and diverse types of government forests by conducting well-designed empirical studies in multiple regions of the world. FAO was aware of our work on irrigation and other resource institutions and hoped that the theoretical foundations of that work could be applied to the study of forestry institutions.[51]

Our research team spent two years developing a series of ten protocols that

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51. *See* IMPROVING IRRIGATION GOVERNANCE AND MANAGEMENT IN NEPAL (Ganesh P. Shivakoti & Elinor Ostrom eds., 2002); WAI FUNG LAM, GOVERNING IRRIGATION SYSTEMS IN NEPAL: INSTITUTIONS, INFRASTRUCTURE, AND COLLECTIVE ACTION (1998); ELINOR OSTROM, CRAFTING INSTITUTIONS FOR SELF-GOVERNING IRRIGATION SYSTEMS (1992); OSTROM, *supra* note 46; SHUI YAN TANG, INSTITUTIONS AND COLLECTIVE ACTION: SELF-GOVERNANCE IN IRRIGATION (1992).

would enable us to obtain reliable information on the ecological condition of the forests to be studied and good information about how institutions related to forest governance were devised and monitored, and whether or not they were successful in the field. In the process of designing our protocols, we involved the advice and input from more than 100 researchers and policymakers located in all regions of the world. We consulted officials who were implementing National Environmental Action Plans to ascertain the types of information they needed for future policy. We worked with several forest departments to add measures that were of importance to them. We sought the help of researchers who have a major interest in questions of biodiversity and forest sustainability as well as the impact of institutional arrangements.

The core set of ten protocols that resulted from this wide consultation process is designed to enable scholars to examine the impact of diverse ways of owning and governing forests (such as individual ownership, joint ownership by a community, and different forms of government ownership) on investment, harvesting, protection, and managing activities and their consequences on forest conditions, including biodiversity.[52] We have developed a large relational database that is used to record structured and qualitative data in a consistent manner across sites. The core protocols are designed so that additional questions can be addressed in specific studies designed by collaborating researchers by adding a specific set of questions to one of the existing protocols, or by adding a new protocol such as a household survey.

A long-term collaborative research network has now been established with centers located in Bolivia, Colombia, Guatemala, India, Kenya, Mexico, Nepal, Tanzania, Thailand, Uganda, and our own center in Bloomington, Indiana. Research using the IFRI protocols has also been conducted in Brazil, Mali, and Madagascar. Together, colleagues in the network have collected data in more than 200 sites and revisited 41 of them at least one time. As of December 1, 2004, we have taken a random sample of 8695 forest plots and actually measured 127,712 trees (including diameter, height, and species). This has involved a very large effort to devise appropriate sampling plans, locate the sample plots in forests, and measure the trees, shrubs, and groundcover in the plots with regard to ecological measurements. We also conduct in-depth individual and group interviews with members of user groups, organize discussions with local public officials, draw on archival records when available, develop accurate maps, enter the collected data into the database, and write initial site reports to be given back to the communities where we have conducted our studies.

The studies reported here draw upon forest rules, monitoring activities, and rule-making rights as recorded in the IFRI database. In addition to the diverse forest mensurations taken in each forest, assessments are made by an independent forester and by forest users on several key variables related to vegetation. An independent forester or ecologist is asked to rank the vegetation density of the study forest in comparison to other forests in the same ecological zone. The

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52. Ctr. for the Study of Institutions, Population, and Envtl. Change, Indiana University, International Forestry Resources and Institutions Research Program Field Manual (Aug. 2004, ver. 12).

vegetation density in the forest under study is ranked on a five-point scale from very sparse to very abundant. Similarly, the forest users are asked to rank forest condition from very sparse to very abundant. These qualitative assessments provide a measure of forest cover that can be used to compare forests across ecological zones. In the studies discussed below, we specify whether the forester's assessment and/or the community assessment is used to determine forest vegetation density.

C. Analysis of Changes in Forest Cover Reflected in Over-Time Satellite Images

CIPEC researchers also have actively used remotely sensed data in many of our research efforts.[53] The analysis of several remotely sensed images over a decade or more is a particularly useful technique for examining the impact of institutional arrangements, as we illustrate below. In our discussion of Myth 1 below we present a multi-temporal composite of the Maya Biosphere Reserve in northern Guatemala developed by Edwin Castellanos, Glen Green, and Victor Hugo Ramos. A composite is constructed by overlaying satellite images of a site taken on three different dates covering two sequential time periods. The original composite uses colors to represent stages of clearance and regrowth. When converted to a black-and-white image, the areas that were stable throughout the relevant time period are uniformly dark. Areas that have experienced substantial forest conversion are light grey and white. A color composite of the Maya Biosphere Reserve and color composites from Madagascar, Uganda, Brazil, and Nepal are analyzed in the Supporting Online Material to Dietz, Stern, and Ostrom's article in *Science*.[54]

IV. FINDINGS: CHALLENGING THREE MYTHS OF FOREST PROTECTION

Findings by CIPEC researchers challenge the beliefs that protected areas are the only way to protect forest lands and that resource users are unable to enforce or create forest management rules. Deforestation is driven by a complex web of factors acting at local, national, and global scales. Demographic, economic, technological, institutional, cultural, and sociopolitical forces all interact with

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53. EMILIO F. MORAN & ELINOR OSTROM, SEEING THE FOREST AND THE TREES, HUMAN-ENVIRONMENT INTERACTIONS IN FOREST ECOSYSTEMS (forthcoming July 2005); Dengsheng Lu et al., *Relationships between Forest Stand Parameters and Landsat TM Spectral Responses in the Brazilian Amazon Basin*, 198 FOREST ECOLOGY & MGMT. 149 (2004); Harini Nagendra et al., *Accessibility as a Determinant of Landscape Transformation in Western Honduras: Linking Pattern and Process*, 18 LANDSCAPE ECOLOGY 141 (2003); Harini Nagendra, *Tenure and Forest Conditions: Community Forestry in the Nepal Terai*, 29 ENVTL. CONSERVATION 530 (2002); Charles M. Schweik et al., *Using Satellite Imagery to Locate Innovative Forest Management Practices in Nepal*, 32 AMBIO: J. HUM. ENV'T 312 (2003); Jane Southworth et al., *Assessing the Impact of Celaque National Park on Forest Fragmentation in Western Honduras*, 24 APPLIED GEOGRAPHY 303 (2004).

54. Dietz et al., *The Struggle to Govern the Commons*, *supra* note 46.

biophysical features of the land to produce patterns of deforestation.[55] Empirical studies of forest management demonstrate that while in certain conditions protected area policies are effective in controlling deforestation, they are not foolproof solutions to resolve all of the complex factors driving deforestation. The following CIPEC findings counter three myths about forest protection that are pervasive in the conservation community.

A. Myth 1: Only Legally Designated Protected Areas Will Maintain Forest Cover

The protected area model is based on the assumption that conservation requires government ownership and regulation.[56] In order to test whether government ownership and protected area regulations are necessary for forest protection, Hayes compared forest vegetation density in 76 legally designated, government-owned protected areas to forest vegetation density in 87 forests that are not legally designated as protected areas.[57] The data about these forests are contained in the IFRI database. The findings demonstrate that both legally defined, government-owned protected areas (which we refer to as "parks") and other types of institutions ("non-parks") that include forests managed by private owners, local forest users, or national government agencies are capable of conserving forests.

Figure 1 shows the results from the cross-national comparison of forest vegetation density in IFRI forests that are parks contrasted with IFRI forests that are non-parks. All of the parks in the sample are government-owned protected areas. Non-parks include public, private, and communally owned forested lands used for a variety of purposes. Forest vegetation density is the ranking assigned to the forest by the forester or ecologist who participated in the measurement of trees, shrubs, and groundcover in a randomly selected set of forest plots after the completion of forest mensuration. As mentioned above, the assigned ranking is a five-point scale from very sparse to very abundant.[58]

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55. IUCN, *supra* note 18; HECHT & COCKBURN, *supra* note 27; MORAN & OSTROM, *supra* note 53; SUSAN C. STONICH, "I AM DESTROYING THE LAND": THE POLITICAL ECOLOGY OF POVERTY AND ENVIRONMENTAL DESTRUCTION IN HONDURAS (1993); Helmut J. Geist & Eric F. Lambin, *What Drives Tropical Deforestation?*, LUCC REPORT NO. 4 (2001); Eric F. Lambin et al., *The Causes of Land-Use and Land-Cover Change: Moving Beyond the Myths*, 11 GLOBAL ENVTL. CHANGE 261 (2001); Emilio F. Moran et al., *Household Demographic Structure and its Relationship to Deforestation in the Amazon Basin, in* PEOPLE AND THE ENVIRONMENT: APPROACHES FOR LINKING HOUSEHOLD AND COMMUNITY SURVEYS TO REMOTE SENSING AND GIS 61 (Jefferson Fox et al. eds., 2003); Emilio F. Moran et al., *Strategies for Amazonian Forest Restoration: Evidence for Afforestation in Five Regions of the Brazilian Amazon, in* AMAZÔNIA AT THE CROSSROADS: THE CHALLENGE OF SUSTAINABLE DEVELOPMENT 129 (Anthony Hall ed., 2000).

56. MOLNAR ET AL., *supra* note 7; SOCIAL CHANGE AND CONSERVATION, *supra* note 6.

57. TANYA M. HAYES, PARKS, PEOPLE, AND FOREST PROTECTION: AN INSTITUTIONAL ASSESSMENT OF THE EFFECTIVENESS OF PROTECTED AREAS (Ctr. for the Study of Institutions, Population, and Envtl. Change, Working Paper No. CWP-04-01, 2004).

58. When forests are located within the same ecological zone, we use the extensive data

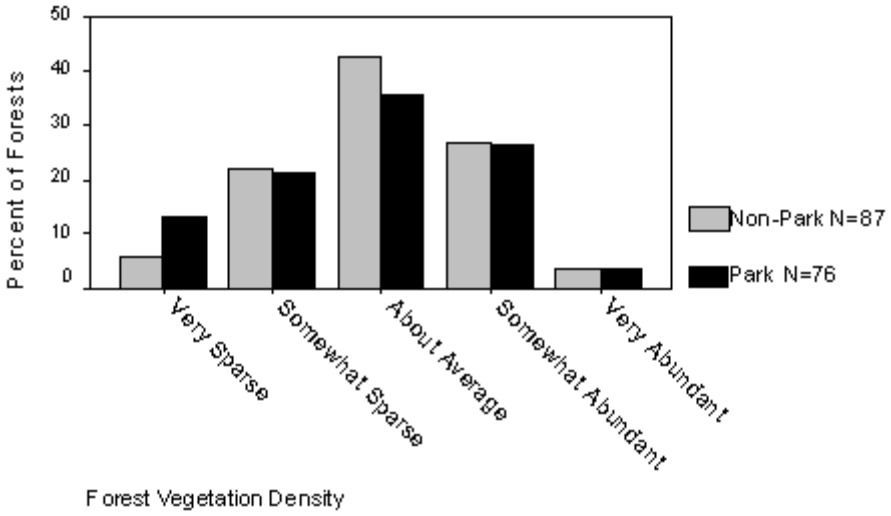

Figure 1. Comparison of Vegetation Density in Parks and Non-Parks. The Kolmogorov-Smirnov Z score is 0.472; the asymptotic significance (2-tailed) value is 0.979.[59]

A Kolmogorov-Smirnov test compares the distributions of forest vegetation density in the two datasets and can be used to determine if the two distributions differ significantly. The Kolmogorov-Smirnov Z score is 0.472, and the p value for that score is 0.979. As the graph illustrates and the test results confirm, *no* statistically significant difference exists in forest vegetation density between parks and non-parks. In other words, formally protected areas do not have a higher frequency of abundant forest vegetation density than areas with alternative institutional arrangements. Legal designation of protection is by no means a requisite for forest maintenance. Furthermore, government ownership of forest lands is not correlated with higher levels of vegetation density. The IFRI study found no correlation between vegetation density and forest tenure type (private, communal, or public).[60]

A closer look at other CIPEC studies illustrates some of the complex factors that influence forest conservation within and outside protected areas. For example, land-cover change in the Maya Biosphere Reserve in the Petén region of northern Guatemala demonstrates both the ability and inability of protected areas to control deforestation (see Figure 2). It also demonstrates the important role that biophysical features and institutional recognition and legitimacy play in forest conservation. The Maya Biosphere Reserve covers more than 21,000

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obtained from detailed forest mensuration, including diameter at breast height, basal area, species diversity and dominance, and others. These measures, however, are not useful when we compare forest conditions across ecological zones as we do in this Article.

59. Hayes, *supra* note 57, at 18.

60. *Id.* at 15.

km^2 and consists of four national parks, three wildlife reserves, a multiple-use zone, and a buffer zone. The national parks and biotopes are strict conservation regions in accordance with the recommendation of IUCN category II.[61] The multiple-use zone permits limited extractive forest activities, and the buffer zone permits sustainable forest use and agricultural practices.

As Figure 2 illustrates, the four national parks in the Maya Biosphere Reserve show mixed conservation results. An analysis of Landsat images from 1986, 1993, and 2000 shows that two of the national parks, El Mirador–Río Azul and Tikal, have very little deforestation and remain almost intact. In contrast, Sierra del Lacandón National Park and Laguna del Tigre National Park show signs of substantial deforestation between 1986 and 2000.

The biophysical attributes of the region as well as the institutional history of the creation of the four national parks within the Maya Biosphere Reserve are some of the factors that contribute to the stability of forests in El Mirador–Río Azul and Tikal. In El Mirador–Río Azul, biophysical features contribute to forest protection. The national park is located in the remote, northern region of the Maya Biosphere Reserve and is accessible only by a three-day trip by mule or helicopter.[62] The park is officially managed by the Guatemalan Institute of Anthropology and History and the National Protected Areas Council. Nevertheless, it appears that the remote location of the park may be responsible for the forests' protection rather than its institutional designation as a protected area. As *ParksWatch* reports, despite the ecological value of the region, El Mirador–Río Azul lacks a management plan and coordinated monitoring and enforcement between the two responsible agencies.[63] Fortunately, due to its remote location, the park is not presently threatened by over-exploitative activities.

In contrast, the location of the Tikal National Park does open it to the potential for outside encroachment. Nevertheless, the composite image in Figure 2 shows that the park has kept its forests relatively intact. The major threats to sustainability are fires started in neighboring territories to clear for agriculture or ranching, and illegal extraction of forest products have produced some forest

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61. IUCN Category II is defined as a

> natural area of land and/or sea, designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area, and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.

IUCN, THE IUCN PROTECTED AREA MANAGEMENT CATEGORIES (Information Sheet No. 3, July 2002), *available at* http://www.iucn.org/themes/wcpa/wpc2003/pdfs/outputs/pascat/pascatrev_info3.pdf.

62. Supporting Online Material to Dietz et al., *The Struggle to Govern the Commons*, *supra* note 46, at 10, *available at* http://www.sciencemag.org/cgi/data/302/5652/1907/DC1/1 [hereinafter Supporting Online Material].

63. ParksWatch, *Eli Marador-Río Azul*, *at* http://www.parkswatch.org/parkprofile.php?l=eng&country=gua&park=mrnp&page=sum (last visited Mar. 23, 2005).

thinning.[64]

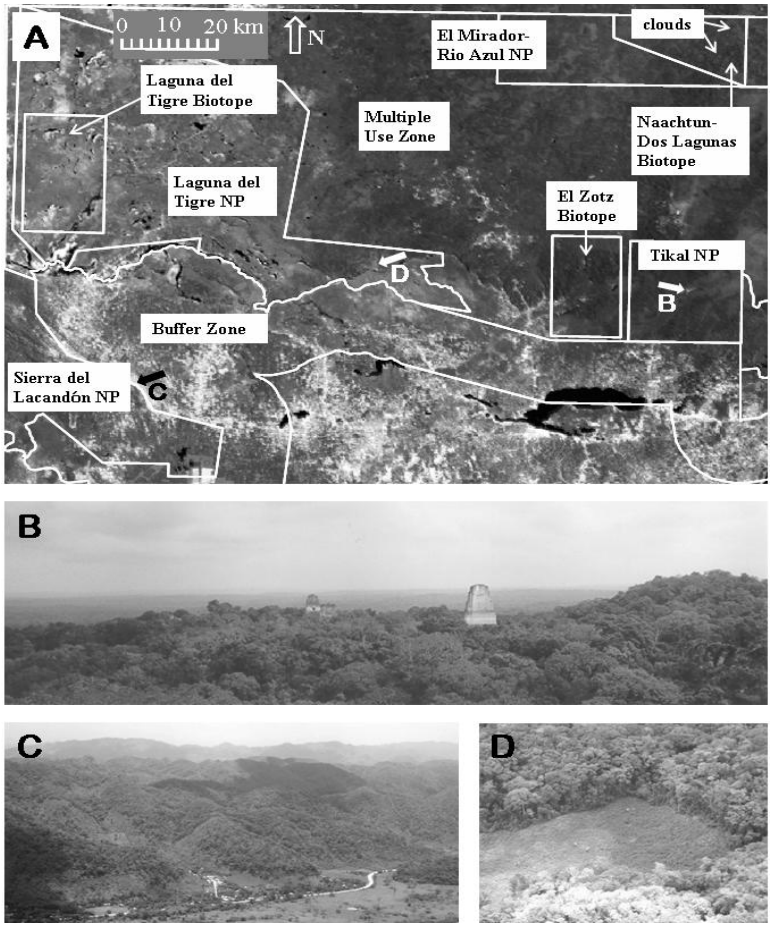

Figure 2. A multitemporal composite of the seven protected areas (national parks and biotopes) and multiple use and buffer zones in the Maya Biosphere Reserve in northern Guatemala (from the Supporting Online Material, *supra* note 62, at 10; composite created by Edwin Castellanos, Victor Hugo Ramos, and Glen Green). Tikal National Park has been monitored effectively, and the forest cover is stable (evidenced by the uniform dark color). Two other northern areas are also stable, due to their inaccessibility. The other four protected areas have experienced substantial illegal logging, conversion to agriculture, and other uses (evidenced by the extensive inroads shown in light gray and white). Official designation as a Biosphere Reserve is not sufficient to protect biodiversity unless substantial investments are made in maintaining and enforcing boundaries.

Widespread recognition of the ecological and cultural value of Tikal National Park, combined with strong institutional and financial support, promote effective

64. Supporting Online Material, *supra* note 62, at 11.

conservation. Created in 1955, Tikal was well established before the region experienced a dramatic advance of the agricultural frontier in the 1980s and before the creation of the Maya Biosphere Reserve in 1990. Tikal is nationally and internationally acclaimed for its cultural and biological uniqueness. It is also financially successful. Revenue from entry fees not only covers the park's entire budget, but also contributes to the Guatemalan Ministry of Culture and Sports. As a result, Tikal is one of the best-staffed protected areas in Guatemala with well-paid park guards and park officials who are held accountable for the continued protection of the park.[65]

Laguna del Tigre National Park and Sierra del Lacandón National Park have been far less successful in preventing deforestation. These parks do not have the biophysical and institutional advantages that El Mirador–Río Azul and Tikal have. Unlike El Mirador–Río Azul, these parks are located in the accessible southern region of the reserve on the edge of the buffer zone. And, whereas Tikal was well established and recognized as a site of national heritage before farmers and ranchers moved to the region, Laguna del Tigre and Lacandón were created as part of the Maya Biosphere Reserve *after* an aggressive colonization policy established by the Guatemalan government encouraged farmers and ranchers to migrate to the region in the 1980s. The parks have since had to try to mitigate the effects of a previous policy that encouraged agricultural expansion into the forested lands.

The present protected area policies are not able to stave off expansion. The numerous light grey and white patches showing the most recent forest cuts demonstrate that these parks have been unable to restrain farmers, ranchers, and loggers from pushing deeper into the forests.[66] In Laguna del Tigre, the underpaid and understaffed park rangers are unable to prevent illegal activities within the park's borders. Although the Lacandón National Park has a management plan, permanent park staff, equipment, and the best infrastructure support in the Maya Biosphere Reserve, *ParksWatch* reports that park officials are still unable to control illegal activities and that the park's biological diversity is critically threatened.[67]

A recent study of the area within and surrounding the Royal Chitwan National Park in the terai region of Nepal also challenges the presumption that effective conservation is likely to occur primarily in government-owned, protected areas. Nagendra, Southworth, Tucker, Carlson, Karmacharya, and Karna have analyzed regeneration patterns across a time series of remotely sensed images of the Chitwan Valley.[68] They found that the buffer zone accounts for a major part of the regeneration occurring in this landscape. While there is considerable donor-assisted funding to the buffer zone to encourage regeneration, the buffer zone lies outside the park and is not a legally defined protected area.

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65. *Id.*

66. *Id.*

67. ParksWatch, *Sierra del Lacandón*, *at* http://www.parkswatch.org/parkprofile.php?l=eng&country=gua&park=slnp&page=sum (last visited Mar. 22, 2005).

68. Harini Nagendra et al., *Remote Sensing for Policy Evaluation: Monitoring Parks in Nepal and Honduras*, ENVTL. MGMT. (forthcoming).

The findings from the cross-national study, the in-depth case study of the Maya Biosphere Reserve, and the recent study of Royal Chitwan National Park illustrate that while parks do provide forest protection in some settings, their performance varies substantially across sites. Parks are not always effective, nor are they necessarily better at forest conservation than other institutional alternatives.

B. Myth 2: Top-down Enforcement of Protected Area Rules Is Necessary to Protect Forest Cover

In *Requiem for Nature*, John Terborgh argues that communities cannot be left to govern themselves.[69] He stresses that local communities are unable to manage their resource systems and that enforcement must not be voluntary. According to Terborgh, "[a]ctive protection of parks requires a top-down approach because enforcement is invariably in the hands of police and other armed forces that respond only to orders of their commanders."[70]

No doubt exists that monitoring and enforcement are critical in forest management. Studies of protected areas have consistently found monitoring and enforcement correlated with effective conservation management.[71] Similarly, common-pool resource management scholars have found that clearly defined boundaries, monitoring, and a system of graduated sanctions are important components of sustainable resource management systems.[72] Common-pool resource scholars, however, have not found that monitoring and enforcement must be administered by a third party.[73] CIPEC studies of forest management underscore the importance of monitoring and enforcement, but challenge the belief that local resource users cannot monitor and enforce forest management rules.

Work by Gibson, Williams, and Ostrom reinforces the findings that rule monitoring and enforcement are critical for forest protection.[74] Their findings also demonstrate that forest users can enforce forest rules. Gibson and colleagues analyzed the rule-monitoring behavior of 178 forest user groups located in 12 countries and coded them in the IFRI database. The user groups included in this study vary substantially in their organization, level of activities, and age. Seventy-five of the user groups included in the study were substantially organized—they elected their own officials, held regular meetings, and undertook

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69. TERBORGH, *supra* note 28.

70. *Id.* at 170.

71. *See, e.g*, IUCN, *supra* note 18; WWF, *supra* note 14; Bruner et al., *supra* note 47.

72. THE DRAMA OF THE COMMONS, *supra* note 46; OSTROM, *supra* note 46; Margaret A. McKean, *Management of Traditional Common Lands (Iriaichi) in Japan, in* MAKING THE COMMONS WORK: THEORY, PRACTICE, AND POLICY 63 (Daniel W. Bromley et al. eds., 1992).

73. OSTROM, *supra* note 46; Clark C. Gibson et al., *Local Enforcement and Better Forests*, 33 WORLD DEV. 273 (2005); Margaret A. McKean, *Success on the Commons: A Comparative Examination of Institutions for Common Property Resource Management*, 4 J. THEORETICAL POL. 247 (1992).

74. Gibson et al., *supra* note 73.

joint activities. On the other hand, 29 of the user groups did not undertake any collective activity with regard to the forest they used—they simply shared similar legal standing in relationship to a forest and harvested forest products for household or commercial purposes. The other user groups varied between these two levels of organization.

In our group interviews with members of these groups, we asked them to report on the regularity with which participants in a group monitor or sanction others' rule conformance.[75] We also obtained measures of the group's social capital, their dependence on forest resources, and their assessment of forest abundance. In general, we found a strong correlation between the level of user group monitoring and forest condition (assessed by the users themselves as well as measured by foresters). We found that the level of user group monitoring and enforcement was correlated with assessments of forest condition even when we controlled for the level of social capital in a group, whether a group was formally organized or not, and whether a user group was heavily dependant on a forest.[76] Thus, not only do some user groups monitor each others' activities for conformance with rules, the level of such activities is positively associated with better forest condition.

Detailed case studies of forest monitoring and enforcement suggest that protected areas may be more effective when they complement local rule enforcement mechanisms. In Uganda, CIPEC colleagues Abwoli Banana and William Gombya-Ssembajjwe found that protected area policies that acknowledge forest dwellers' use rights encourage the dwellers to collaborate with forest officials in order to protect their forests.[77] Banana and Gombya-Ssembajjwe compare forest condition in four government forests: Lwamunda, Mbale, Echuya, and Bukaleba. Lwamunda, Mbale, and Echuya are all roughly 1000–1200 hectares. Bukaleba is larger and encompasses 4500 hectares. All of the forests are managed by the Ugandan Forest Department, which is governed by centralized state policies and characterized by a lack of local participation and insufficient human and financial resources.

The critical difference in management policies is that in Echuya the Forest Department staff allows an Abayanda pygmy community to live in and appropriate products from the forest on a daily basis. All other forest users are only allowed to enter the forest once per week.[78] In their study, Banana and Gombya-Ssembajjwe find less degradation and illegal activities in Echuya than

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75. The frequency of a user group's monitoring and sanctioning was coded as never, occasionally, seasonally, or year-round. For analysis, the responses of "never" or "sporadic" were re-coded as "sporadic," and those of "seasonally" and "year-round" were coded as "regular." The variable does not distinguish the source of the rules that were monitored but rather the level of effort that a user group devoted to monitoring established rules in the forest they used.

76. Gibson et al., *supra* note 73.

77. Abwoli Y. Banana & William Gombya-Ssembajjwe, *Successful Forest Management: The Importance of Security of Tenure and Rule Enforcement in Ugandan Forests, in* PEOPLE AND FORESTS 87 (Clark C. Gibson et al. eds., 2000).

78. *Id*.; *see also* William Gombya-Ssembajjwe, *Institutions and Sustainable Forest Management*, 45 UGANDA J. 51 (1999).

in Lwamunda, Mbale, and Bukaleba forests. The authors attribute Echuya's success, in part, to the monitoring activities of the Abayanda pygmy community who report violations to the Forest Department staff. The authors note that the physical layout of the park also helps protect it, as only one road passes through the forest.[79]

Similarly, a CIPEC study of forest management in Rondônia, Brazil, found greater levels of forest protection when protected area policies coincided with forest users' local institutions than when forest protection policies alienated local traditions.[80] In the 1980s, Brazil's Institute of Colonization and Agricultural Reform established two adjacent colonization projects in northeastern Rondônia, each with distinct property rights systems and architectural design. One project, Vale do Anari, followed the traditional colonization model that laid out an orthogonal road design in which each farmer was assigned 50 hectares of land, of which 50% was to be preserved as forested land and 50% could be used however the settler desired. In contrast, the other colonization project, Machadinho d'Oeste, was laid out to create 16 forest reserves and developed the settlement based on the area's topography. In this settlement, farmers were able to use their land however they liked so long as they respected the reserve forests. Rubber tappers had long lived in these forests and were given rights to help devise a management plan and use the reserve forests. In his research, Batistella found that the rubber tappers soon became unofficial, but active, reserve monitors.[81]

The success of the Machadinho d'Oeste project compared to the Vale do Anari project is illustrated by Landsat images that show the percentage of forest cover loss over time. Images from 1988, 1994, and 1998 show that in 1988, during the initial implementation of the projects, both settlements had similar percentages of forest and pasture. However, by 1998 the overall rate of deforestation in Anari was consistently higher than in Machadinho.[82] The satellite images demonstrate that, while individuals in both settlements deforested lands for pasture and agriculture, the reserve boundaries in Machadinho were maintained and less forest fragmentation occurred in Machadinho than in Anari.[83]

As the individual case studies and cross-national investigation confirm, forest users are able to monitor and enforce forest regulations. In fact, as the Uganda and Brazil examples demonstrate, when local institutions and participation are carefully considered in protected area policies, forest users can be crucial in the

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79. Banana & Gombya-Ssembajjwe, *supra* note 78.

80. MATEUS BATISTELLA, LANDSCAPE CHANGE AND LAND-USE/LAND-COVER DYNAMICS IN RONDÔNIA, BRAZILIAN AMAZON (Ctr. for the Study of Institutions, Population, and Envtl. Change, Dissertation Series No. 7, 2001) [hereinafter BATISTELLA, LANDSCAPE CHANGE]; Mateus Batistella et al., *Settlement Design, Forest Fragmentation, and Landscape Change in Rondônia, Amazonia*, 69 PHOTOGRAMMETRIC ENGINEERING REMOTE SENSING 805 (2003) [hereinafter Batistella et al., *Settlement Design*].

81. BATISTELLA, LANDSCAPE CHANGE, *supra* note 80.

82. Batistella et al., *Settlement Design*, *supra* note 80.

83. Supporting Online Material, *supra* note 62.

invocation and application of forest protection policies.

In some settings, "nature," rather than government officials, protects a park. As shown in Figure 2, the remote location of a protected area may be largely responsible for its preservation. El Mirador–Río Azul in the Maya Biosphere Reserve is only accessible via helicopter or a three-day mule trip. This park is apparently in very stable condition even though little planning has been invested in monitoring and enforcement of its boundaries. Similarly, Southworth, Nagendra, Carlson, and Tucker have found that the core areas of Celaque National Park in western Honduras are largely protected due to their inaccessibility and location at elevations above 2300 meters.[84] Many members of local communities surrounding the park are not aware of the park's existence or, if they know that a park is in the region, they do not know the exact location of the boundaries, and little investment has been made in monitoring and enforcement. The recent expansion of coffee production and agriculture, however, has generated considerable pressure on the park's boundaries. Thus, the preservation of the core of this park is not the result of effective management by Honduran government officials.

C. Myth 3: Local People Are Unable to Make Appropriate Rules

Counter to the presumption that local people are either unable or unwilling to identify forest management requirements and make appropriate rules, IFRI studies of forest management show that resource users are capable of crafting forest rules. Research on the correlation between forest product rules and forest vegetation density in more than 80 IFRI forests in 13 countries finds that the right of user groups to define the forest rules is significantly correlated with forest vegetation density at the 0.05 level.[85]

In the study, rule-making abilities are compared between forests that have above-average vegetation density to forests that have below-average vegetation density, as assessed by the independent forester or ecologist who had completed the forest mensuration. As Figure 3 illustrates, forest vegetation density is sparser in forests where users do not have the right to define the forest rules and higher in forests where they have rule-making responsibilities. In 24 of the 41 forests ranked as having below-average vegetation density, not a single user group has rule-making responsibilities. In contrast, in 24 of the 43 forests considered to have above-average vegetation density, all user groups participate in forest rule making.[86]

The majority of the protected areas in the IFRI study do not give local people the right to make forest product rules for the forests they use. Seventy percent of the non-parks permit all user groups to participate in the forest rule making, compared to only 22% of the parks. Granting rule-making rights to local forest users increases the likelihood that there will be forest product rules to regulate forest use. Investigation of rule making in IFRI forests finds the presence of

84. Southworth et al., *supra* note 53.

85. Hayes, *supra* note 57, at 17.

86. *Id.* at 14.

forest product rules positively and significantly correlates with the ability of user groups to make rules. For example, in 25 of the 39 forests where all user groups are able to make decisions, rules for all forest products have been established by these groups. In only 1 of the 39 forests where users are able to make rules did users decide not to make any rules for the forest products they use. The presence of forest product rules is also significantly correlated with higher levels of vegetation density. Protected areas, however, do not promote the creation of forest product rules. The officially protected areas in the IFRI database have less than half the number of rules than non-parks.[87]

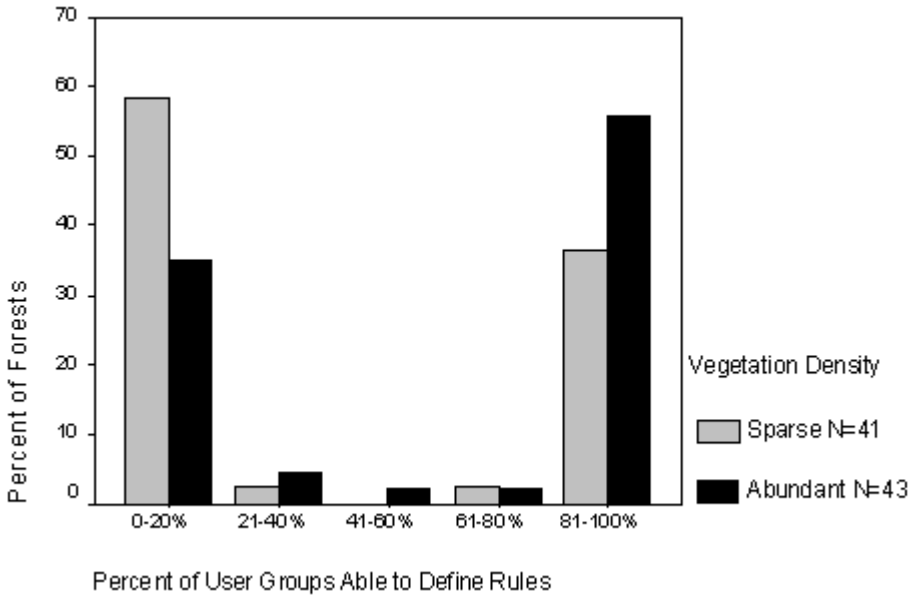

Figure 3. Vegetation Density Associated with User Group Right to Make Rules.[88]

A promising finding from the IFRI study is that parks that give local users rule-making rights have higher levels of vegetation density than parks that do not allow users to make rules. As Figure 4 demonstrates, the parks that do not give any of the local users rule-making abilities have significantly sparser forests than the parks that grant local rule-making responsibilities. A Spearman's rho correlation coefficient of 0.345 confirms a positive correlation between user group rule-making rights and forest vegetation density that is significant at the 0.05 level. These results echo the findings in Uganda and Brazil that inclusion of local forest users and their institutions in protected area planning and administration may complement park policies for protecting forest cover.

87. *Id.* at 13.

88. *Id.* at 20.

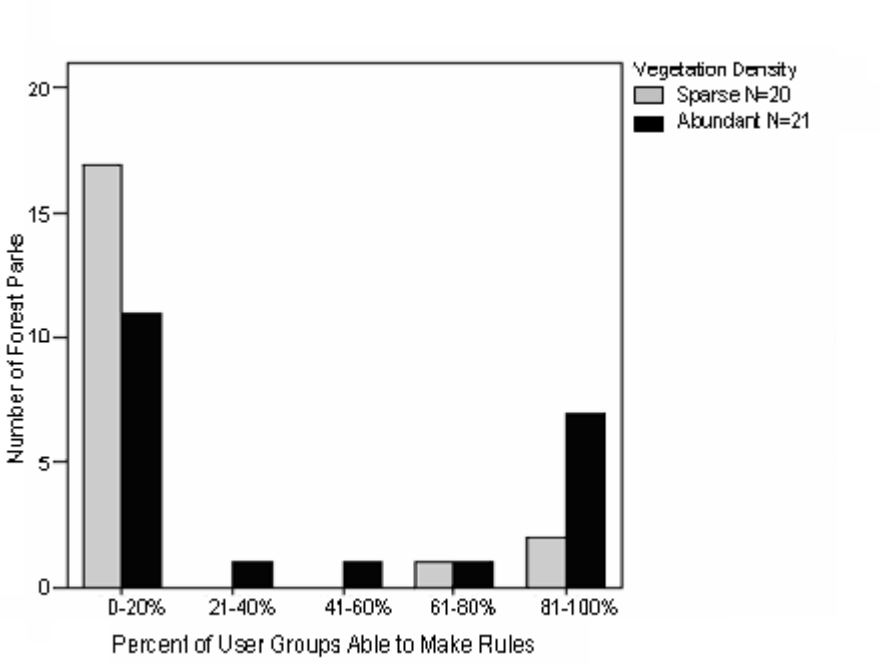

Figure 4. Forest Park Vegetation Density Associated with User Group's Right to Make Rules

V. POLICY IMPLICATIONS

The above findings have several policy implications for forest management, specifically protected area planning and policy design. First, the findings from the IFRI study on protected area forests and several of the case studies clearly refute the belief that *only* legally designated protected areas conserve forests. The findings suggest institutional legitimacy, biophysical features, and the perspective of local residents may greatly influence the ability of a protected area to retain the forest cover within its borders. The findings from case studies as well as the comparative IFRI studies all emphasize the importance of local recognition and respect for protected area policies.

Second, local participation in rule making, monitoring, and enforcement are consistently shown to be significant factors in protecting forest cover. In Uganda and Brazil, protected area administrators increased the legitimacy of the protected area policies and decreased monitoring costs by granting certain local users forest access and use rights in addition to rule-making and monitoring responsibilities. IFRI results show that local users who have been granted rule-making rights have forests with higher levels of vegetation density than those who do not have those rights.

Finally, a topic of constant debate in the conservation arena is over the level of participation that resource users should have in protected area rule-making and management. Few systematic studies have documented whether local participation makes a difference in forest conservation. The results from the IFRI

study on protected areas finds that protected area policies that enable residents to make forest rules are more likely to maintain forest cover. This is an important finding for all involved in protected area planning and implementation.

CONCLUSION

The above findings clearly contradict the belief that protected areas are the only way to conserve forests. While legal designation of protection may contribute to a basic institutional infrastructure that supports conservation, legal designation alone is never enough to ensure forest protection. As the empirical findings from the IFRI studies demonstrate, protected areas do not have higher levels of forest vegetation density than forests that are not legally designated as protected areas. Similarly, the composite image of forest-cover change in the Maya Biosphere Reserve in Guatemala clearly shows that protected area policies do not ensure forest conservation. Instead, forest conservation depends on a web of factors, including, but not limited to, local recognition of the validity of the protected area policy, biophysical features, financial and human resource support, and mechanisms for conflict resolution.

One of the most significant lessons from the empirical studies discussed above is the importance of understanding and recognizing local-level institutions in forest conservation. Local resource users' rule making and monitoring and enforcement activities are significantly and positively correlated with abundant vegetation density. Protected area policies can provide a broader institutional framework, but it is often the local resource users who determine whether conservation policies will be successful. The IFRI forest study shows that, on average, protected areas that do not allow forest users to make rules are ranked lower in vegetation density. The case studies from Uganda and Brazil show forest conservation in protected areas to be, in part, dependent on the monitoring and enforcement activities of the local forest users.

We still have much to learn about policy tools and legal mechanisms for forest conservation. The above findings take a nuanced approach to forest management and begin to dig into the specific policies and legal rights that may promote forest conservation. We still need to investigate what rights and responsibilities should be given to different resource users in different contexts, given that the principal goal is forest conservation. Nevertheless, these findings contradict the presumptions that resource users are incapable of crafting and enforcing forest management rules. They also contradict the belief that strictly regulated protected areas are the *only* way to ensure forest conservation. Instead, they suggest that a system of rights and conservation policies that link state and local conservation efforts may lead to greater protection of the world's forests.