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Parks, People, and Forest Protection: An Institutional Assessment of the Effectiveness of Protected Areas

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Summary. — Are parks effective in forest conservation? This study examines data from 163 forests in 13 countries to determine the necessity of legally established protected areas for forest conservation and alternative conditions and institutions that may conserve forests. The results show no statistically significant differences in forest conditions between legally protected forests and forests governed by users who establish and recognize forest rules. Furthermore, higher levels of vegetation density and significantly more forest rules exist in areas not legally protected. The dearth of rules in protected areas suggests that parks may not be the optimal governance structure for promoting local conservation.

Key words — global conservation, environmental policy, community resource management, cross-national evaluation, deforestation, forest parks

1. INTRODUCTION

In 1962, the World Conservation Union (IUCN) institutionalized protected areas by defining a protected area as "an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means" (UNEP-WCMC, 2004). Today the IUCN World Commission on Protected Areas estimates that there are approximately 100,000 protected areas that fall into one of six conservation categories ranging from areas that strictly limit human activity to those that allow for sustainable human use. But despite the large number of protected areas, few researchers have conducted empirical studies to test whether parks are effective conservation tools (notable exceptions include studies conducted by Bruner, Gullison, Rice, & da Fonseca (2001) and the World Bank/WWF Alliance (1999)). This paper responds to the question Are parks effective? Central to this question is not simply whether parks are effective conservation tools but, more specifically, whether protected areas are a more effective means of environmental conservation than other institutional arrangements.

Previous research has used case studies to either support or condemn protected areas,

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with most studies debating the degree to which local residents should be incorporated into protected area management activities (Brandon & Wells, 1992; McNeely, 1995; Redford & Richter, 1999; Stevens, 1997a, 1997b; Terborgh, 1999; Wells & Brandon, 1992). Taking protected areas as a fact, the debate then asks, How much should a community participate in their management? But the assumption that only official parks are legitimate conservation tools clouds the question of the effectiveness of community input and limits the scope of possible conservation arrangements.

In order to gain a better understanding of the institutional arrangements that promote forest conservation, this study uses data gathered from 163 forests by the International Forestry Resources and Institutions (IFRI) research network. The study was designed to test whether forests in legally designated protected areas, hereinafter "parks," that fall within one of the six IUCN categories of protection are in better condition than forests that have no legal designation of protection, hereinafter "non-parks." A non-park may be privately, communally, or government owned. The objectives of this study are to determine (1) the necessity of legally established protected areas for forest conservation and (2) alternative conditions and institutions that may promote forest conservation.

I begin by examining how park effectiveness has traditionally been considered in the literature and argue that the current debate limits the scope and innovative arrangements that promote in situ conservation. I then expand the scope of the discussion through a series of tests to examine the difference between forest conditions in parks and non-parks and the institutional factors that influence these conditions. Given the difficulties in comparing forests across ecological zones, I use forest vegetation density in comparison to forests in the same ecological zone as a proxy for forest condition. Vegetation density is not a comprehensive measurement of forest condition, but it does illustrate how one forest compares to another in the same ecological zone and enables an empirical assessment of forest condition across zones. The results demonstrate a significant correlation between rules acknowledged and crafted by forest users and forest vegetation density and challenge the assumption that parks are the most appropriate management arrangement.

2. ARE PARKS EFFECTIVE? THE LIMITATIONS OF THE PEOPLE–PARK DEBATE

The literature on the effectiveness of protected areas tends to remain within the confines of parks and focuses on park management policies. Given that some sort of state-mandated designation of protection is necessary for environmental conservation, the question of effectiveness focuses on whether park policies are adequately protecting biodiversity and the degree to which local residents should be involved in decision-making processes and management responsibilities.

On one side of the debate are advocates for the traditional park model. They argue that protection of biodiversity depends on state-established protected areas that prohibit human residents and strictly regulate consumptive and non-consumptive activities. The majority of parks established before the 1980s followed exclusionary state-run approaches (Ghimire & Pimbert, 1997). On the other side are those who contend that successful conservation depends on greater community participation and control over park creation and management decisions. In the 1970s, continued environmental degradation and increasing conflict in protected area environs compelled many park advocates to recognize the social costs that parks and nature reserves imposed on local people—often the most marginalized populations (Brockington, 2001; Igoe, 2004). Acknowledging resident dependency on the natural resource base, many conservationists began to promote an alternative park model—people-centered or community conservation (McNeely, 1995; Stevens, 1997b; Western, 1997; Western & Wright, 1994). Advocates for participatory conservation approaches insist that by denying local people access to protected areas and by excluding them from decision-making processes, conservationists create tension between park mangers and local residents, increase monitoring costs, and fail to benefit from valuable local knowledge and resource management systems (McNeely, 1995; Wells & Brandon, 1992; Western & Wright, 1994).

In recent years, the conservation debate has come full circle with respect to the best way to manage protected areas. Countering arguments by Wilhusen, Brechin, Fortwangler, and West (2002), Stevens (1997b), Phillips (interviewed in Borrini-Feyerabend, 2002), and others that parks will only be sustainable in the long term if they incorporate local communities into the decision-making process, Terborgh (1999), Redford and Richter (1999), and Locke and Dearden (2005) question the tenets of sustainable development and assert that only strict nature preserves will adequately protect biodiversity. Locke and Dearden (2005) warn that the recent paradigm shift toward greater community participation weakens the ability of protected areas to preserve wild biodiversity, and Terborgh insists that "active 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 from their commanders" (1999, p. 170). Building on reports of the inefficiencies of integrated conservation and development projects (Wells & Brandon, 1992; Larson, Freudenberger, & Wyckoff-Baird, 1998; Poteete & Ostrom, in press, discussing Sayer *et al.*, 2000), Chapman (2003) lends economic support to the traditional park model by claiming that parks are best managed publicly, due to their geographic scope, personnel requirements, and funding needs.

Given the mounting arguments against the environmental efficacy of community-based conservation programs and the recent backlash against sustainable development and local participation in resource management, it appears that the pendulum may be once again swinging in favor of the traditional park paradigm. Nevertheless, the question remains: Are protected areas effective?

Despite declarations by some conservationists that protected areas are necessary to conserve biodiversity, there is little evidence to support these statements (Gibson, Williams, & Ostrom, 2005; Hayes & Ostrom, 2005; Nagendra *et al.*, 2004). Due to the limited amount of empirical information and the high costs of gathering such data, few large-sample studies have examined if, when, and how parks are effective (Hockings & Phillips, 1999; Hockings, Stolton, Dudley, & Phillips, 2000; O'Neil, 1996).

A notable exception is the Bruner and colleagues' (2001) study of the effectiveness of 93 protected areas throughout the tropical world. In this study, the authors examine the ability of parks to buffer against anthropogenic threats to tropical biodiversity. They find that yes, parks are an effective means of protecting biodiversity, and that this effectiveness is highly correlated with the density of guards monitoring an area and the probability that a guard will apprehend and sanction an offender. Furthermore, they suggest that parks are more effective than the alternatives, namely sustainable forest management and integrated conservation and development projects, and conclude that parks should be a core component of conservation strategies (Bruner *et al.*, 2001).

Several methodological issues need to be carefully considered before using this study to endorse the effectiveness of protected areas. First, the study is based on responses to a questionnaire that surveyed park officials about the conditions inside and outside their respective parks. As the authors of the World Bank/WWF Alliance study (1999) note in their survey of the threats to protected areas, asking a park official to rate a park within his or her jurisdiction may give biased results. Furthermore, many of the questions asked in the survey, such as the amount of hunting or grazing within and around a park, may have been beyond the park officials' informational scope and cannot be considered empirical data, but rather gross estimations of the environmental conditions within and outside a park.

Of additional concern is Bruner and colleagues' (2001) failure to examine other institutional arrangements. Their opening paragraph asks how well parks measure up to the alternatives of sustainable forest management and community conservation projects. However, they never examine these alternative arrangements. Bruner and colleagues' argument that parks are more effective than the alternatives is based on a comparison of activities and conditions within a park to those within a 10-km buffer adjacent to each park. For example, in order to determine whether park policies are effective in curbing resource use, the authors asked park officials to compare agriculture, ranching, and hunting activities within the park and within a 10-km buffer outside of the park. In addition to the empirical limitations mentioned above, this comparison does not consider the history of the region and the possibility that prior to receiving legal designation as protected, the land lying within a park's boundaries may have been in significantly better condition than the surrounding lands.

Part of the key to evaluating the effectiveness of protected areas is first deciding what the park aims to conserve, and second, if a park is better at conserving that particular environmental good than other possible arrangements. For example, if a protected area's goal is to conserve forest habitat and it is compared to a nearby region of land that has been dedicated to commercial farm production, then yes, a protected area may be more effective than a commercial farm in conserving forested land. But, on the other hand, if the protected area is compared to a community woodlot, it is questionable as to whether the protected area is more effective than the community in conserving forest habitat.

In failing to compare the environmental conditions within strictly protected areas to the conditions in forests governed by other institutional arrangements, such as community forests, or parks that permit a degree of consumptive usage, the authors speciously endorse the use of exclusionary protected area policies. Their findings that boundary demarcation, monitoring, and enforcement correlate with park effectiveness echo the findings of many institutional scholars on effective resource management (Agrawal, 2000; Banana & Gombya-Ssembajjwe, 2000; Dietz, Ostrom, & Stern, 2003; Gibson, Lehoucq, & Williams, 2002; Gibson, McKean, & Ostrom, 2000; Ostrom, 1990, 1999a). However, Bruner and colleagues (2001) do not demonstrate that these institutional components are only present in parks. While their work contributes to our understanding of the institutions that encourage sustainable resource management, the study does not demonstrate that strictly protected areas are more effective at crafting these institutions than other resource management arrangements.

This paper takes a step back from the protected area debate to examine the effectiveness of parks compared to locally governed areas and then asks what overall attributes contribute to effective conservation. Protected areas provide a variety of environmental benefits, many of which are difficult to measure. In order to simplify the question, this paper focuses on the conservation of forests. Specifically, I compare the forest vegetation density of parks with that of non-parks.

The paper asks three principal questions: First, are parks more effective than non-parks in maintaining better forest conditions? Second, how do rules for forests and forest products relate to forest condition? And finally, how prevalent are locally recognized forest rules in parks and non-parks?

3. DESCRIPTION OF IFRI PROTOCOL, DATA, AND METHODS

I use IFRI data to analyze the differences between parks and non-parks. The IFRI research program began in the mid-1990s, and the growing database is a result of ongoing collaboration between an international network of scholars who are engaged in producing long-term comparative research on forests, the people who use forests, and the institutions for forest management (Ostrom, 1998).

The IFRI research program is designed 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) and their consequences on forest condition. In determining study site selection, IFRI research centers are asked to select forests that represent the distribution of forest governance systems operating in each of their respective countries (CIPEC, 2002). The sites are not selected based on the success or failure of any one governance system; however, all sites are slightly biased because they must contain forests. Therefore, they are all relative successes since forests that have been completely lost under any governance system are absent from the study. This is a limitation of any static analysis of forests.

The data for each forest were collected using standard IFRI protocol specifically designed to identify how investment, harvesting, protection, and managing activities influence forest conditions. The protocol prescribes a methodology for defining the site boundaries, conducting forest plot mensuration, and gathering qualitative data on the attributes of the different communities of forest users, the institutions governing the forest, and the types of products used in the forest. The IFRI forest is the unit of analysis, and each case study includes a forest and all communities that use the forest.

Three key terms used in the IFRI analyses are forests, forest users, and institutions. By definition, an IFRI forest must encompass at least 0.5 hectares and be used (for consumptive and/or non-consumptive purposes) by at least three households. Forests may lie on private, public, or communal land, and the forest users may have varying degrees of rights to access and use the forest. Forest users are individuals who harvest from, use, and maintain a forest. Although not necessary, the individual users most often live in or near the forest. According to IFRI protocol, forest institutions are rules that constrain human behavior. This paper frequently refers to forest rules. These rules are not limited to formal, official rules and may include norms, rules, and traditions defined by local forest users (CIPEC, 2002). A distinguishing characteristic of a forest rule is that it is recognized and understood by the majority of forest users. In the case of protected area forests, a forest may be legally designated as protected, but its respective codes of conduct will not be recorded as rules unless they are recognized by forest users.

The data in this study were gathered from IFRI forest studies conducted during 1993–2000. The dataset with information on both legal status and vegetation density in forests includes 163 forests in 13 countries: Uganda (26), Nepal (47), India (40), Kenya (5), Tanzania (3), Madagascar (8), Bolivia (9), Brazil (3), Ecuador (1), Guatemala (7), Honduras (1), Mexico (6), and the United States (7). Seventy-six of these forests are parks, and 87 forests are non-parks.

(a) *Description of variables*

For each question the dependent variable is forest vegetation density. One of the greatest challenges in conducting cross-country analysis is designing a method whereby different forests from different ecological zones can be compared. Forests in this study include tropical and subtropical evergreen forests, temperate evergreen forests, deciduous forests, evergreen woodlands, and mainly deciduous woodlands. While the forest plot-level mensurations generate a rich dataset with information on the types and number of trees, saplings, and groundcover plants, we are thus far unable to standardize these data to compare forest conditions across ecological zones. For example, a given basal area may represent a forest in excellent condition in a region of Guatemala but a forest in poor condition in Uganda.

Therefore, in order to compare forests across ecological zones in this study, the dependent variable is forest vegetation density as determined by an independent professional forester. The forester is an independent consultant hired by IFRI to participate in the forest mensuration study and is asked to rank the condition of the vegetation density of this forest in comparison to other forests in the same ecological zone. Thus, the dependent variable here is an ordinal variable where a forest is ranked as very sparse, somewhat sparse, about normal for this ecological zone, somewhat abundant, and very abundant.

It is important to note that vegetation density is only one measure of forest condition. The professional forester's opinion of vegetation density does not adequately assess all of the elements that are necessary to discern the environmental health of a forest. The qualitative assessment of vegetation density asks a forester to overlook nuanced differences and provide an overall evaluation of the forest. Of particular concern is that in making this assessment, the forester may not have specific criteria from which to gauge differences between forests and may therefore tend to record that a forest is "about normal." Given this possible bias toward the median, many of the statistical tests in this paper are conducted using a restricted dataset that includes only those forests that have either above-average vegetation density (somewhat abundant and very abundant) or below-average density (somewhat sparse and very sparse).

The restricted dataset includes 99 cases; 50 forests have below-average vegetation density and 49 have above-average vegetation density. There are 49 parks and 50 non-parks in the restricted set. In tests using the restricted dataset, the actual number of cases may vary from the total pool of 99. When studies from multiple researchers in multiple countries are used, some information is often missing. In order to clarify the analyses, in each test I specify whether the complete or restricted dataset is used, the specific number of cases, and, when relevant, the number of forests falling into each of the respective categories.

Studies of forest conservation suggest that the difference in forest condition may be explained, in part, by institutions that restrict forest use (Banana & Gombya-Ssembajjwe, 2000; Gibson *et al.*, 2000, 2005; McKean, 2000; Ostrom, 1999a, 1999b; Varughese, 1999). In addition to testing the effect of legal designation of protection on forest vegetation density, I examine four other institutional variables that are linked to each IFRI forest:

(1) *User group identification*. In the IFRI database, a user group is defined from the pool of forest users by those who share the same rights to products from a forest and the associated duties. The user group may or may not be formally organized (CIPEC, 2002). User group identification is a variable that stratifies those users who have consciously formed as a group for a reason and those users who never self-

consciously formed (they simply share similar rights). There is often more than one user group for each forest. The user group variable is the percent of all user groups that identify themselves as having formed self-consciously for a specific reason in order to use or benefit from a particular forest. For example, if IFRI has identified five user groups that use an IFRI forest, but only one of the groups consciously considers itself to be formed, the user group variable for that forest would be 0.20, or 20%. The reason for including this variable is to test whether a basic level of organization within a forest user group leads to higher levels of forest vegetation density.

(2) *Forest rules*. Forest rules are rules stated by forest users that govern the use of the forest. The forest rules are focused on forest products. Each forest may provide a number of timber and non-timber forest products. Products are defined by a list that prioritizes the top three forest products (consumptive and non-consumptive) used by each user group for each forest. [1] The product-rules variable represents the cumulative percent of rules for all forest products used by the user groups for a particular forest. These rules may include harvesting, processing, or selling stipulations that affect the harvesting level or use of the forest product. The rules may be local rules or norms created by the forest users or they may be formal rules dictated by government policies. Some examples of the types of forest rules encountered include when certain forest products may be harvested, what parts of specific trees may be harvested, who has the right to harvest, and the types of technologies that may be used. In the dataset, there are a total of 83 forests for which there is information about the presence of rules. Seventeen forests have no forest product rules, and 38 forests have rules for all of the products listed by the user groups. The remaining forests have rules for some, but not all, of the forest products.

(3) *User-defined rules*. This variable defines local rules. It represents the percent of total user groups who are responsible for making rules about a forest. In the dataset there are a total of 84 forests with information about the ability of user groups to define forest rules. Of these 84 forests, 39 forests do not allow any user groups to make forest rules, and an equal number allow all user groups to be involved in rule making. The remaining six forests allow some, but not all of the user groups to determine forest rules.

(4) *User-defined sanctions*. This variable represents the percent of products for which user groups can decide the appropriate sanction when a harvesting rule is broken. The default condition of this variable (i.e., zero) is the government. This dataset is reduced from the restricted dataset because it includes only those forests that have product rules. The question of sanctioning is not applicable in forests without rules.

(b) *Methods*

I have chosen to compare the data by using several descriptive tests, including *t*-tests for comparison of means, Kolmogorov–Smirnov tests to compare distributions, chi-square tests of independence, and bivariate tests for correlation. The initial intent of this study was to compare the effectiveness of parks to non-parks by conducting regression analyses on specific institutional, demographic, and biophysical factors hypothesized to influence forest condition. Unfortunately, in considering the specifications for a credible causal model, I ran into several statistical challenges including selection bias, missing variables, and endogeneity. In addition, the non-experimental nature of the data and the number of challenges it presents prevent the use of typical statistical fixes (Gibson *et al.*, 2005).

Thus, in order to determine whether parks are more effective than the alternatives, I used the Kolmogorov–Smirnov test to determine if there are significant differences in the distribution of forest vegetation density between the 76 parks and the 87 non-parks. The Kolmogorov–Smirnov test compares the distributions of the two datasets and tries to determine if the two distributions differ significantly. The null hypothesis for this test is that there is no difference in forest condition between parks and non-parks.

I test for a correlation between forest vegetation density and each of the four institutional variables (user group identity, forest product rules, user-defined rules, and user-defined sanctions) using a Spearman's rho test for correlation. The dataset is confined to the restricted dataset of forests that includes only those forests that are in either above-average condition or below-average condition. The hypotheses are that user group identity, the presence of forest product rules, the ability of users to define forest rules, and the ability of users to sanction are each positively correlated with forest vegetation density. The Spearman's rho correlation is also used to test for a positive correlation between the presence of forest product rules, the ability of users to make rules, and parks.

4. RESULTS

(a) *Vegetation density in parks and non-parks*

The results show no real difference in the distribution of vegetation densities between the parks and the non-parks. Table 1 and Figure 1 illustrate the similarities between the two distributions of vegetation density. The Kolmogorov–Smirnov Z-score is 0.472, and the p-value for that score is 0.979. In other words, legally protected areas do not have a higher frequency of high forest vegetation density than areas with alternative institutional arrangements.

(b) *Correlations between forest rules and forest conditions*

The results show that rather than a legal definition of protection, it is the rules acknowledged and made by forest users that influence forest condition. The graphs in Figures 2 and 3 illustrate what the statistical results in Table 2 confirm: the presence of forest product rules and the ability of users to make rules are both strongly correlated with vegetation density. Figure 2, demonstrating the correlation between the presence of rules and forest conditions, shows that of the 42 forests ranked as having below-average vegetation density, 13 forests (31%) have no product rules. In contrast, only four of the 41 forests ranked as having above-average vegetation density have no forest product rules. Similarly, 23 (56%) of the forests ranked as above-average have rules for all of the products used by the user groups of those respective forests.

The importance of rules invoked by forest users is reinforced by the correlation between vegetation density and the ability of user groups to define forest rules. Forest vegetation density is sparser in forests where the users are unable to determine the forest rules and is higher in forests where they have rule-making responsibilities. In 24 of the 41 forests ranked

Table 1. *Vegetation densities of forests in parks and non-parks*

	Very sparse	Somewhat sparse	About average	Somewhat abundant	Very abundant	Total
Non-park	5 (6%)	19 (22%)	37 (43%)	23 (26%)	3 (3%)	87 (100%)
Park	10 (13%)	16 (21%)	27 (36%)	20 (26%)	3 (4%)	76 (100%)

Percent of total forests is shown in parentheses.

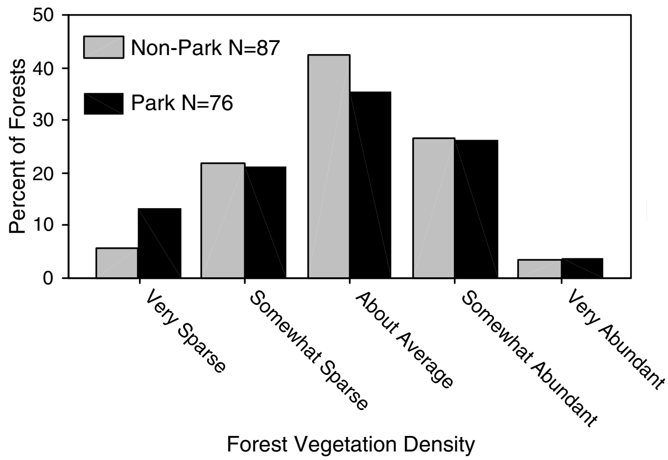

Figure 1. *Comparison of vegetation density in parks and non-parks. The Kolmogorov–Smirnov Z-score is 0.472; the asymptotic significance (two-tailed) value is 0.979.*

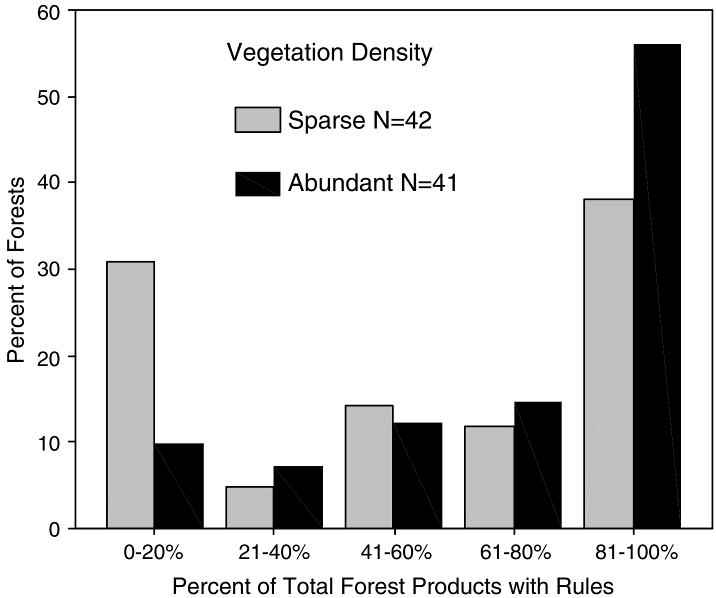

Figure 2. *Vegetation density based on forest product rules.*

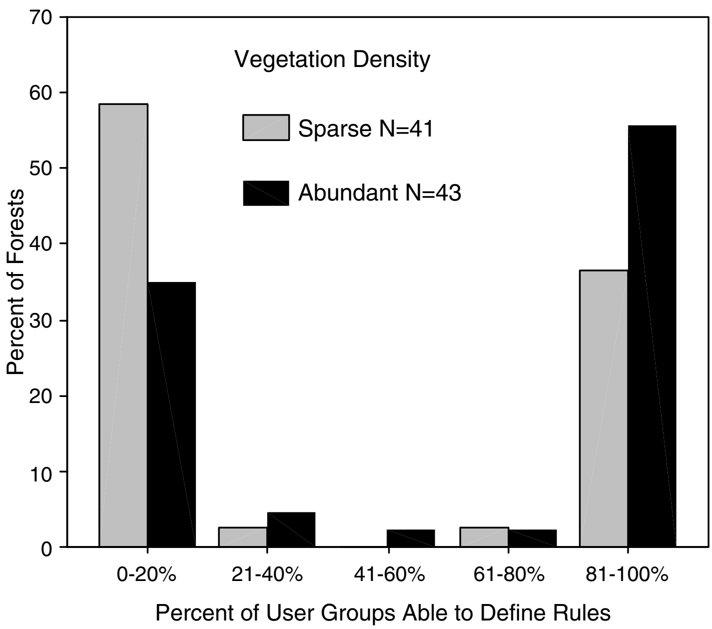

Figure 3. *Vegetation density based on the ability of users to define rules.*

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.

Table 2. *Spearman's rho correlations*

Variable	Coefficient	Significance	*N*
Group identity	0.050	0.647	87
Presence of forest rules	0.252*	0.022	83
User-defined rules	0.222*	0.043	84
User-defined sanctions	0.049	0.699	64

* Significant at 0.05 level (two-tailed).

The results are striking in that not only the presence of rules, but also the ability of the users to make the rules for the forests they use are both positively correlated with vegetation density, with the presence of product rules and user-defined rules both statistically significant at the 0.05 level. While user group identity is not strongly correlated to vegetation density, the correlation is in the predicted direction. Similarly, user-defined sanctions are not strongly correlated with forest vegetation density.

(c) *Presence of forest rules in parks and non-parks*

Given the significance of forest product rules and user-defined rules, the next question to consider is how parks compare to non-parks in the provision of rules and the ability of users to make those rules. Figures 4 and 5 show the presence of rules in parks compared to non-parks and the percentage of user groups that are able to decide forest rules in both parks and non-parks. In both cases, the graphs show that parks have significantly fewer product rules than non-parks and that the user groups are generally not able to establish the forest rules in parks.

With respect to the presence of rules, 60% of the 43 non-parks have rules for all of the forest products compared to only 30% of the 40 parks. Similarly, more non-parks have user-group–defined forest rules than parks. Seventy percent of the non-parks permit all user groups to participate in the forest rule making, compared to only 22% of the parks.

Spearman's rho correlation coefficients confirm what the charts graphically illustrate. Using a dummy variable in which 1 represents a park and zero a non-park, Spearman's rho correlation test shows a negative relationship between parks and the presence of rules. The coefficient for the presence of forest product rules and parks is −0.384, a value that is statistically significant at the 0.01 level. Similarly, the ability of user groups to make forest rules is also negatively correlated with parks. Spearman's rho coefficient of −0.467 is also statistically significant at the 0.01 level.

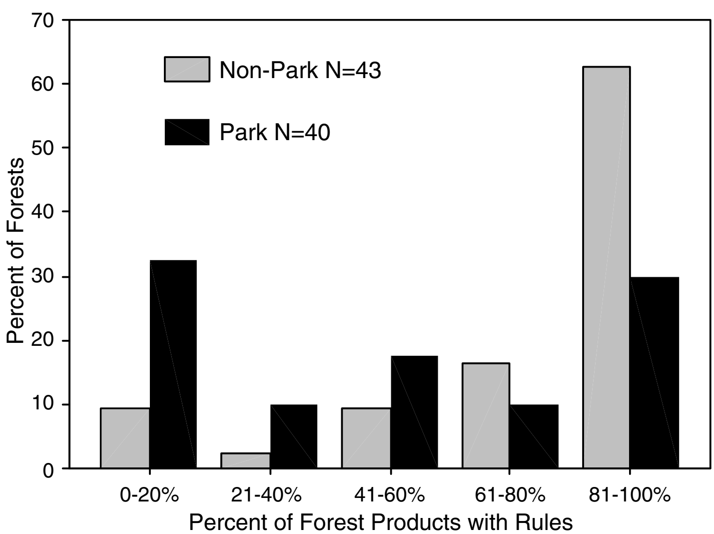

Figure 4. *Presence of forest product rules in parks and non-parks.*

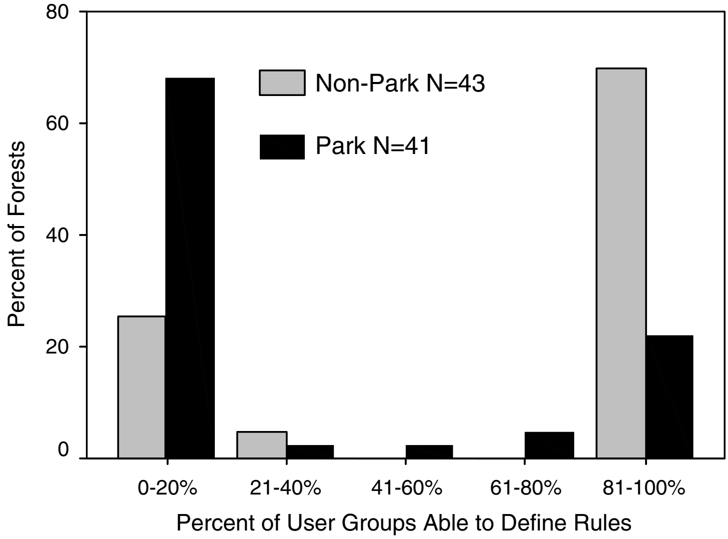

Figure 5. *Ability of users to define forest rules in parks and non-parks.*

5. DISCUSSION

This study's results point to several crucial policy and research ramifications. First, returning to the initial question of the effectiveness of parks, this study demonstrates that in the IFRI sample of 163 forests, legally designated protected areas are not more effective at protecting forest vegetation density than other institutional arrangements. This finding suggests that protected areas are not the only policy tool for effective conservation. Furthermore, conservationists should be cautious in declaring protected areas as a policy prescription, as future research is needed to understand how other governance systems may also provide for environmental protection.

Second, the study informs the protected area debate by demonstrating the importance of rules that are recognized and created by forest users. Rather than official designation of protection, it is the rules in use by residents that influence forest protection. These findings suggest that if protected area managers seek to promote forest conservation, then the residents should be included in the rule-making processes.

Finally, by stepping out of the protected area debate and examining a broader scope of institutional arrangements, the study demonstrates that alternative institutional arrangements can conserve forest cover. It shows that, contrary to the assumptions made by traditional park advocates, resource users are able to craft rules that are appropriate for their environments and encourage sustainable resource use. In fact, non-parks had twice as many rules as parks. The prevalence of rules in non-parks demonstrates the local knowledge that resource users possess about the many products that a forest can provide, and when given the opportunity, people will establish rules to manage each of these products.

6. CONCLUSIONS

This study began with two objectives. The first, to determine if parks are more effective than the alternatives, has been met. Parks are not the only way to conserve forests. The second objective, to determine alternative institutional arrangements that might be more effective, is open to further research and discussion. This study has made headway by discovering the significance of forest rules used and crafted by resident populations. These preliminary findings suggest that greater attention needs to be paid to the effect that local conditions and local institutions have on resource management.

This analysis also demonstrates that forest rules may not necessarily be enough. Despite the prevalence of forest rules in non-parks, the distribution of vegetation densities in non-parks was the same as in parks. Neither non-parks nor parks are able to consistently account for high levels of vegetation density. This suggests that further research is needed to better understand the interplay between drivers of deforestation and institutions for forest management.

NOTES

1. Although the IFRI form specifically asks for only three products, exceptions are made if a user group uses less or more than three products. Therefore, some user groups may have four or five products listed, while another group may have only one.

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