AN INSTITUTIONAL APPROACH TO THE STUDY OF FOREST RESOURCES

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Jeffrey Sayer and colleagues at CIFOR recently found that it has been more difficult to establish Integrated Conservation and Development Projects (ICDPs), including World Heritage Forests, than to popularize and fund the idea of forest conservation projects. Many conservation projects have been formally established, but "there are still very few clearly successful cases where local people's development needs and aspirations have been reconciled with protected area management" (Sayer et al., 2000: 14). Consequently, there has been ". . . a growing realization that ICDP's have run the risk of contributing effectively neither to conservation nor to development. The result is a big gap between rhetoric and reality" (ibid.) They urge those interested in effective conservation as well as successful economic development to base future strategies for the design of conservation projects on "the expensive lessons we have learned over the past decade" (ibid.).

This call to learn from the expensive lessons of the past challenges scientists and policymakers interested in sustainable forests. The task is complicated by the complexity of forest ecosystems and the interactions between ecosystems and social systems. Many biophysical (B), demographic (D), economic (E), and institutional (I) factors affect forest conditions. These include:

[1] The IFRI research program involves the study of forests, people, and institutions by a network of Collaborating Research Centers (CRCs) in 13 countries. The Workshop in Political Theory and Policy Analysis and the Center for the Study of Institutions, Population, and Environmental Change are jointly responsible for coordination of this program. Funding from the Ford Foundation, the MacArthur Foundation, and the National Science Foundation (SBR 9521918) is gratefully acknowledged. The authors thank Clark Gibson for thoughtful comments and Patty Zielinski for her careful editing.

- climatic conditions (B);
- soil characteristics (B);
- altitude, slope, and aspect (B);
- population size, change, and rate of change (D);
- market demand and shifts in relative prices (E);
- local institutions for resource management (I); and
- government policies (I).

Most forestry research focuses on the biophysical rather than the demographic, economic, or institutional aspects of changing forest conditions. Those who do examine human impact often see humans as a threat—often the primary threat—to the sustainability of forest resources and biodiversity. The concentration on human impacts is more on the demographic or economic more than the institutional (Agrawal, 2001, 2002; Kaimowitz and Angelsen, 1998).

Depictions of humans as threats to forest survival provided past justification for the nationalization of forested areas, and now justify efforts to create and expand protected areas. Exclusionary strategies like these, however, do not offer a promising basis for sustaining forests on a global scale. The difficulty of monitoring forest access and utilization results in imperfect enforcement in most settings. Even if it were possible to keep people physically out of forests, externalities from nearby human activities would continue to affect forest conditions. Anthropogenic influences cannot be eliminated from forest ecosystems. Fortunately, human influences are not just destructive.

One need not be a neo-Malthusian to expect growing demands to strain limited resources. And yet, there are reasons to doubt that population growth or increasing market pressure translates directly into resource depletion (Agrawal, 1995). Instead of driving humanity to its

destruction, population growth is thought by some to be the engine of technological progress, which can be used to prevent resource depletion (Boserup, 1965). Reality presents more complicated pictures than either the Malthusian tragedy or the Boserupian march of technological progress. Some societies experience resource depletion with population growth or increased market pressure; others manage to sustain their forest (and other) resources despite comparable pressures. Agrawal and Yadama (1997) argue that these differences arise because institutions mediate demographic and socioeconomic pressures with variable effectiveness.

Multiple studies reveal the absence of a relationship between population growth and loss of forest cover at the local level (Varughese, 1999, 2000; Fairhead and Leach, 1996; Agrawal, 1995; Fox, 1993). Regional and national-level studies, however, frequently find that population growth is positively related to deforestation.[2] Although the correlations between population growth and deforestation at the national level may reflect poor data quality rather than actual patterns,[3] it is not uncommon for the direction of a relationship to change with the scale of observation (Gibson, Ostrom, and Ahn, 2000). It may be the case that, although local institutions for forest management ameliorate the effects of increasing demographic pressure, such institutions are not sufficiently widespread within countries to compensate for high national levels of population expansion (Wily and Mbaya, 2001). If true, policies promoting institutional development at the local level could change the national relationship between population growth and loss of forest cover (Sekher, 2000). Promotion of institutional development requires a solid understanding of the determinants of local organization and successful forest management. Even in the absence of

[2] Some studies at these larger scales show no relationship. See the extensive empirical research summarized in Kaimowitz and Angelsen (1998) and Rudel (1994). Mertens et al. (2000) explain the relationship between population growth and deforestation in the Cameroon as mediated by a substantial economic crisis.

[3] The common practice of using figures for national deforestation estimated on the basis of population change raises serious questions about the robustness of these relationships (Kaimowitz and Angelsen, 1998: 86-87).

such policies, a better understanding of collective action and self-organization would shed light on the existing variation in forest management within countries.

International efforts to develop criteria and indicators of sustainable forest management reflect a growing recognition that human interventions can promote the sustainability of forests. Criteria and indicators provide tools for monitoring forest conditions based on current understandings of relationships between ecological and social systems (Prabhu, Colfer, and Dudley, 1999). Criteria refer to essential elements of sustainable forestry; indicators identify observable signs that particular criteria or elements of sustainable forestry are being met. The movement to develop criteria and indicators can be understood as an effort both to build international consensus on what sustainable forestry entails, and to fill the gaps in current knowledge about empirical forest conditions and management practices (FAO, 2001). The criteria and indicators approach offers ways to monitor conditions expected to favor sustainability based on the best scientific knowledge available. The approach does not, however, attempt to evaluate the actual sustainability of forests (Prabhu, Colfer, and Dudley, 1999). The criteria and indicators approach is thus more helpful for monitoring based on the current state of scientific knowledge than for improving scientific theories about sustainable forestry. Comparatively little effort has been devoted to studying conditions under which people have maintained and even enhanced forest conditions through their stewardship.

Thus, in addition to studying the biophysical, demographic, and economic impacts on forest conditions, it is also important to understand underlying causes and consequences of institutional factors. In some locations and eras, people deplete forest resources through unregulated extraction, while in others people develop institutions to sustain healthy and diverse forests over many generations. Learning about the sources of variation in institutional development is critical for the development of policies that can enhance the probability of the sustainability of forests

and other natural resources. Scientific understandings of change in forest systems, as well as the effectiveness of efforts to promote sustainable forest use, depend upon well-grounded theories about the development, evolution, interaction, and consequences of institutions.

This chapter reviews research on the role of institutions for forestry, focusing on contributions by the International Forestry Resources and Institutions (IFRI) research program. We begin with some background on institutions and the IFRI research program. We then turn to a discussion of collective action as it is related to forest management. We provide an overview of the current consensus about the attributes of a forest and of forest users that are most likely to be associated with efforts by users to organize themselves to protect forest resources. We then turn to a discussion of the contestation regarding the impact of the size of a group and its heterogeneity on the likelihood of self-organization.

In light of these theoretical foundations, we turn to a brief overview of empirical findings from IFRI studies regarding perceptions of dependency, benefits, and costs; local autonomy; group size; and group homogeneity. IFRI studies, in general, provide strong support for the importance of institutions but challenge the view that local involvement in forest management is a panacea for forest management (Campbell et al., 2001; Ostrom, 2001). Our findings illustrate the variety of institutional arrangements that exist in the field. Further, we find that no single blueprint exists for effective management of complex systems such as forests. Nevertheless, because institutions represent a critical component of forest management, institutional approaches must be incorporated into the study of forests and future policy analysis about forests. In the last section of the chapter, we focus on continuing challenges facing the study of forest institutions.

Institutions are commonly understood rules and norms that stipulate what actions are required, permitted, or forbidden in particular situations. Institutions need not be formal, legally recognized, or written, although many are. Institutions may be developed by people seeking to

regulate their own interactions, or originate with external actors (e.g., governments, religious organizations, aid agencies). Except under the rare conditions of abundance, sustaining forest systems requires regulation of forest use. Whether formal or informal, developed by governments or forest-dependent populations, institutions governing the use of forest resources are necessary for the sustainability of those resources even though they frequently are not adequately structured to enhance sustainability (Kaimowitz and Angelsen, 1998; Gibson, McKean, and Ostrom, 2000).

When institutions evolve as unwritten norms or rules in use, they are difficult for outsiders to observe.[4] Analysts can also be misled by formal rules, since they may be ignored or only partially enforced. Unless there are reliable ways to evaluate the existence and effectiveness of rules for forest management, policymakers cannot determine when or how they should intervene. Evidence of the consequences of rules is also needed for evaluations of the effectiveness of interventions. Are local rules or government policies affecting forest management? If so, are they altering forest use in ways that promote or threaten the health of the forest? Even where institutions exist and effectively influence human action, the complexity of forest ecosystems means that it is difficult to predict the consequences for forest health. What conditions favor the development and survival of institutions that regulate forest use in a sustainable manner? To answer questions such as these, links must be drawn between social scientific research on institutions and biophysical indicators of forest health.

[4] Outsiders who collect oral histories of traditional rules from community elders also face the challenge of discerning actual current practices from widely held but no longer followed norms.

The International Forestry Resources and Institutions (IFRI) Research Program

The IFRI research program, established in the mid-1990s, combines careful study of socioeconomic, institutional, and biological factors in a long-term, comparative program of research (Ostrom, 1998a). Data collection encompasses biophysical measures of forest conditions, climatic and soil conditions, demographic information, and economic indicators as well as details about institutions affecting use of forest resources. IFRI researchers return to forest sites every three to five years to conduct repeat studies. The interdisciplinary approach allows assessments of hypothesized relationships among demographic, economic, institutional, and biological variables. With the accumulation of time-series data, it becomes possible to analyze social and institutional processes that take years to unfold.

IFRI relies upon locally based research teams familiar with local languages, conditions, and policy debates. Organization as a network of research centers facilitates comparative research. Members of the IFRI network use the same methods, collect data on a common set of variables,[5] and share data in a growing international database, thereby maintaining the comparability required for cross-national analysis. By building an international database of comparable and repeated studies, IFRI scholars gain the ability to conduct large-N studies and time series analyses.

Scholars interested in IFRI's inherently interdisciplinary approach have formed CRCs in Africa, Asia, Europe, Latin America, and North America.[6] IFRI studies encompass a wide array of forests and institutions. With studies in temperate forests in the U.S., the mountain forests of the Himalayas, and tropical moist and tropical dry forests in Africa, Asia, and Latin America, the

[5] IFRI represents the core, not the limits, of data collection. Many IFRI research teams collect supplemental data to address specific research questions.

[6] As of November 2001, there are 14 IFRI CRCs in 13 countries (see http://www.indiana.edu/~ifri/crcs.htm). The first were established in 1993. Revisits have begun in Nepal, Uganda, the USA, and Kenya (see Becker, Banana, and Gombya-Ssembajjwe, 1995; Gombya-Ssembajjwe, 1999; Schweik, Adhikari, and Pandit, 1997).

research program encompasses diverse ecological conditions. They range from a one-hectare cultural or sacred forest in Uganda to a Bolivian forest reserve of just under 45,000 hectares. Many IFRI forests are owned and managed by a national government, reflecting historical preferences for state control of natural resources in many countries. Other IFRI forests fall under private or communal ownership. These categories mask further diversity. Communal management, for example, occurs when governments grant villagers formal control, but also when local residents exercise *de facto* control in the absence of formal rights. A number of IFRI forests, owned as private property by groups of unrelated individuals, do not fit common understandings of private or communal property. And a variety of management regimes exist in government-owned forests, ranging from management for timber production, protection for wildlife or biodiversity conservation, to joint management with local residents for multiple uses.

An interest in evaluating forest conditions under different management regimes has guided the selection of many IFRI sites.[7] IFRI's interdisciplinary methodology allows comparisons between actual forest conditions and patterns of use associated with particular institutional arrangements. The IFRI research program contributes to research on collective action required for institutional development and survival, and has developed interdisciplinary methods for evaluating the existence and consequences of institutions. These studies caution against deterministic expectations based solely on formal institutions (Gibson, Lehoucq, and Williams, forthcoming; Tucker, 1999). They also join a substantial body of evidence that demonstrates the importance of formal *and* informal institutions in mediating socioeconomic and demographic pressures that might otherwise obstruct collective action or result in resource degradation.

[7] Criteria for site selection vary because each IFRI center develops its own research strategy.

Collective Action Related to Forest Management

Institutions for resource management are products of collective action. Collective action can be problematic because actors often face situations where the temptation to let others bear the costs of providing joint benefits threatens provision of these goods. This collective-action problem is solved in many locations, but goes unsolved (or fails after initial success) in others (Ostrom et al., 1999). What factors influence prospects for collective action for sustainable forest management among resource-dependent populations?

Collective action is not problematic under all circumstances. Problems arise from inadequate information, conflicting interests, or the nature of the good itself. When people lack information, coordination becomes difficult despite common goals (e.g., assurance games). If multiple solutions exist but have different distributional consequences, competition over distributional issues can result in failures to cooperate (e.g., chicken games). Rivalry in consumption and difficulty of exclusion make provision and protection of common-pool resources particularly challenging. Obstacles to exclusion encourage individuals to free-ride on the efforts of others, resulting in underprovision or degradation of the common resource (e.g., social dilemmas).

Consensus Regarding Variables Affecting Likelihood of Collective Action

For management of renewable resource systems like forests, collective action is needed to limit resource use. Attributes of the resource itself, characteristics of the resource users, and relations between the group and the resource, determine the degree of difficulty associated with establishing restrictions on entry or extraction. Sufficient empirical research has been conducted that a consensus is emerging about the attributes of a resource and the attributes of resource users that are conducive to local collective action to create and monitor rules related to harvesting and

use (Ostrom, 1992, 1999; Baland and Platteau, 2000). The variables on which consensus exists include:

Attributes of the Resource:

R1. Feasible improvement: The forest is not at a point of deterioration such that it is useless to organize or so underutilized that little advantage results from organizing.

R2. Indicators: Reliable and valid information about the general condition of the forest is available at reasonable costs.

R3. Predictability: The timing and location of resource units are relatively predictable.

R4. Spatial extent: The forest is sufficiently small, given the transportation and communication technology in use, that users can develop accurate knowledge of external boundaries and internal microenvironments.

Attributes of the Users:

A1. Salience: Users are dependent on the forest for a major portion of their livelihood or other variables of importance to them.

A2. Common understanding: Users have a shared image of the forest (attributes R1, 2, 3, and 4 above) and how their actions affect each other and the resource. They can, in essence, make realistic predictions about likely future results of collective action of diverse types.

A3. Discount rate: Users have a sufficiently low discount rate in relation to future benefits to be achieved from the forest.

A4. Distribution of interests: Users with higher economic and political assets are similarly affected by a current pattern of use.

A5. Trust: Users trust each other to keep promises and relate to one another with reciprocity.

A6. Autonomy: Users are able to determine access and harvesting rules without external authorities countermanding them.

A7. Prior organizational experience: Users have learned at least minimal skills of organization through participation in other local associations or learning about the ways that neighboring groups have organized.

This list offers a set of hypotheses grounded upon findings from a large body of empirical research (see literature cited in Ostrom, 1999). Numerous studies point to the importance of each attribute, giving rise to the broad consensus on their importance. The relative importance of these attributes, the nature of relationships among them, their generality or limitations, and the existence of necessary or sufficient conditions for collective action remain open questions. The IFRI studies discussed below address questions related to the relative importance of these variables and internal connections among them.

Contestation Regarding Size and Heterogeneity of User Groups

In addition to the attributes of a resource and of users about which considerable consensus exists, the likely impact of several variables is hotly contested. In particular, questions abound about the importance of group size and heterogeneity for common understanding, a favorable distribution of interests, or trust. Group size and heterogeneity are widely expected to affect prospects for trust and the degree of divergence in interests, and thus to influence prospects for collective action.[8] Opportunities for frequent interaction increase as the size of the group decreases. Frequent interactions create opportunities to build reputations. The expectation of future interactions increases the value of reputations for cooperative behavior. Moreover, frequent interaction facilitates mutual monitoring. The reputation building and mutual monitoring associated with frequent interactions suggest that smaller groups foster higher levels of trust. If high levels of trust create conditions amenable to collective action, group size should be negatively correlated with collective action.

Homogeneity may have a bearing on collective action. Sharing important social, cultural, or economic characteristics may increase the predictability of interactions (Fearon and Laitin, 1996).

[8] See Agrawal and Gibson (1999, 2001) for related discussions of the concept of community and associated assumptions of small size, frequent interactions, homogeneity, shared interests, and norms.

Predictability may in turn provide a basis for trust. Even if trust does not arise from predictability (e.g., if members of a homogeneous group consider themselves to be predictably opportunistic), common traits suggest common interests. Whether because it promotes trust or reflects common interests, homogeneity may facilitate collective action.

Homogeneity is commonly expected to be higher in smaller groups.[9] Because heterogeneity can exist along multiple dimensions, it is possible for heterogeneity to increase more rapidly than a group's size. The predicted correspondence of small group size with homogeneity of interests provides another reason to expect size to influence prospects for collective action. Unfortunately, the desirability of collective action does not decrease with group size; rather, the importance of collective action grows with demand for common-pool resources. Population growth will indeed threaten natural resources if larger groups have less success at developing or sustaining institutions for collective management of resources. Lower levels of collective action in larger groups could account for the association between population growth rates and rates of deforestation in cross-national comparisons.

Both conceptual and practical problems exist with the hypothesized links between small size, homogeneity, and collective action. What is a small group? To what extent, if at all, does the assessment of size depend on context? How is context important and why? The concept of homogeneity is even more problematic. Individuals differ from one another on many dimensions. Which of these differences affect prospects for collective action and why? Do any forms of heterogeneity promote rather than obstruct collective action? If so, which ones? In Olson's concept of privileged groups, heterogeneous groups enjoy advantages in collective action precisely because some members feel intensely enough about provision of a public good to

[9] Baland and Platteau (2000: 365-66) argue that claims for the desirability of small groups rest more heavily on the expectation of homogeneity than benefits from frequent interactions.

contribute even if others do not; at the extreme, one or a few individuals provide the public good on their own (Olson, 1965; cf., Hardin, 1982: chapter 5). The existence of individuals with a strong interest in collective action raises everybody's expectations about the likely aggregate level of cooperation.

Discussions of the role of homogeneity often assume that the relevant characteristics are known and can be arrayed along a single dimension. These assumptions are not borne out. Equally intense concerns about management of a forest arise from participation in different economic activities. It is difficult to predict whether people will hold opposing or complementary interests in such circumstances. Homogeneity on some dimensions often coincides with heterogeneity on others. Members of a group may have common economic interests, for example, but differ culturally. Cultural differences might impede the development of trust, or be associated with different understandings of the most pressing management issues. Individuals sometimes use cultural differences as the basis for excluding members of one group from the benefits of resources despite apparently shared economic interests. On the other hand, internal policing in ethnically, religiously, or linguistically distinct populations can bolster cross-community cooperation (Fearon and Laitin, 1996). In other circumstances, heterogeneity may be complementary, as when no single subpopulation has access to all of the resources needed for successful collective action (e.g., time, money, specialized skills).

Empirical Results from IFRI Studies

The IFRI research strategy lends itself to systematic empirical testing of relationships between resource attributes and the attributes of groups and how these affect users' perceptions of benefits and costs. Analyses of IFRI data over the past several years have produced insights both in regard to the relative importance of variables about which consensus exists as well as

helping to increase scientific understanding regarding the contested impacts of other variables. We will briefly discuss studies of (1) the role of perceptions about benefits and costs, (2) local autonomy, and (3) group size and heterogeneity.

Perceptions of Dependency and Benefits and Costs

Even when its characteristics favor cooperation, a group is unlikely to invest in collective action unless its members believe that the benefits outweigh the costs. Calculations of costs and benefits depend on each actor's perception of the value of the resource, dependency upon it, its scarcity, and alternative options for investment. Two IFRI studies show that if the people who use forest resources do not depend upon those resources, do not perceive them to be scarce or valuable, or value other investment options more highly, they will not attempt to protect forest resources even if other conditions suggest that they are able to do so (Gibson, 2001; Gibson and Becker, 2000).

Gibson (2001) argues that perceptions of resource salience and scarcity are necessary for collective management of forest resources. Two villages in Guatemala had several characteristics frequently asserted to be associated with successful collective action, including relatively small size, relatively homogeneous interests in the forest, and prior experience with collective action. Although most members of both communities heavily utilized forest resources that forest mensuration suggested were shrinking, members of neither community *perceived* the scarcity in forest resources as sufficient to warrant conservation measures. In contrast, a recognition of the link between the depletion of trees and the scarcity of water did lead one of these villages to create rules to protect a portion of their forest that was in the relevant watershed.

Local perceptions about dependency on indirect forest services strongly affect decisions about protecting forest resources. Failure to recognize public goods associated with forest resources,

such as watershed protection; high present values for immediate consumption of particular goods; and high costs of institutional creation contribute to failures to develop rules to protect the resource base (Gibson and Becker, 2000). The efforts of People Allied for Nature (PAN) in Ecuador, however, demonstrate that perceptions can be changed by presenting findings from interdisciplinary research in participatory settings (Becker, 1999). Such presentations dramatically illustrated the correlation between the amount of water intercepted from fog and forest condition for the villagers of Loma Alta. Tangible evidence of the benefits of standing forest convinced the vast majority of villagers to support the creation of a forest reserve.

Local Autonomy

Although the possibility of changing perceptions to promote forest conservation offers reasons for optimism, it also raises questions about the viability of promoting conservation through radical decentralization (Becker, 1999: 161). Policymakers cannot expect communities in developing countries to cover the high costs of sustainable resource management, especially if they do not recognize the benefits from protection (ibid.; cf., Varughese, 1999). In several of the cases discussed above, local communities had legally recognized property or management rights over the forest, and yet only a portion adopted rules to protect the resource base. Local autonomy might be conducive for successful management of common-pool resources such as forests, but it is not a sufficient condition. The point is illustrated by IFRI studies in Uganda and India.

If given external backing, groups with high dependency on the forest can effectively protect it (Banana and Gombya-Ssembajjwe, 2000). The forest department in Uganda, for example, recognized the management rights of a pygmy community living within the Echuya forest reserve. The efforts of the Abanyanda to protect the forest from incursions by other local residents compensate for the forestry department's inability to enforce national rules for forest

conservation. Considering the history of antagonistic relations with other local populations, it is doubtful that the Abanyanda would have been able to develop effective institutions for forest management in the absence of external support.

If the state or its agents challenges a community's institutions for self-governance, self-governance remains possible but very costly (Ghate, 2000). Lack of state support for local resource management forced villagers in Lekha Menda, India, to use unanimity as an internal decision-rule. If even one member of the community objected to a management rule, the dissenter could call upon agents of the state to overturn a decision with over 90 percent community support. Heavily dependent upon their forest resources, the villagers of Lekha Menda were able to reach unanimous agreement on management rules. Signs of forest regeneration indicate that these rules are effective. Nonetheless, the necessity to use the unanimity rule raises transaction costs, reducing the net benefits the community gains from its efforts. In contrast, external recognition by Ugandan officials meant that the Abanyanda could avoid costly systems for internal decision making and provided them with some protection against challenges by other communities in the vicinity.

The experiences of Lekha Menda suggest that local autonomy is not as crucial for collective action as is dependency on the resource base or perceived scarcity, but the case also reaffirms the value of autonomy. In part, Lekha Menda succeeded despite the absence of legal autonomy because the state intervened only when called in by an influential member of the community.

Group Size and Homogeneity

The level of cooperation within the community of Lekha Menda represents a remarkable achievement; many communities are unable to agree on collective strategies for forest management even when they have local autonomy. Most analysts agree that common

understanding, trust, and a shared interest in resource management facilitate collective action. But, is it possible to identify circumstances under which these features are more likely?

The confusion about the relevant forms of homogeneity casts doubt on any simplistic relationship with either group size or collective action. Recent work begins to grapple with the implications of multiple forms of heterogeneity for collective action (Baland and Platteau, 2000; Ruttan and Borgerhoff Mulder 1999). Evidence from two IFRI sites draws attention to another fly in the ointment: heterogeneity, however understood, is itself affected by institutions (Gibson and Koontz, 1998). Institutions that govern membership influence the degree and types of heterogeneity within the group. Different rules for becoming a member affected the emergence of heterogeneity in two communities with similar origins in southern Indiana. One community set relatively high costs of entry, restricted the use and transfer of land, and limited the recovery of investments upon exit. This community maintained highly homogeneous attitudes towards forest conservation over more than 20 years. Entry into the other community involved little initial cost. A moderate period of membership conveyed the right to obtain land with no restriction on use and the possibility of taking their land with them upon leaving the community. These rules allowed destruction of forest cover by members and reduction of the community's forest as membership changed.

Gibson and Koontz attribute differences in forest conservation to the degree of homogeneity of preferences within each community. In turn, each community's institutions influenced the degree of homogeneity. This argument is noteworthy for a number of reasons. First, it highlights the evolutionary nature of homogeneity, at least in preferences. Just as initial homogeneity influences the development of institutions for forest management, the evolution of homogeneity influences the survival of those institutions. Second, it identifies institutions as sources of

homogeneity as well as potential products of it. The design of institutions can influence the direction taken as preferences evolve, and thus the prospects for sustained cooperation.

The case studies underline the importance of specifying the form of homogeneity that is expected to influence collective action. The community that maintained its forest over two decades shared a preference for forest conservation, but was diverse along other dimensions. In this case, religious, ideological, and socioeconomic heterogeneity did not undermine collective action for forest management. The comparison also calls into question the relationship between group size and homogeneity. Although membership in each community varied over time, both were relatively small at the time of fieldwork. In fact, the collapse of cooperation contributed to declining membership in one group. Small groups need not be more homogeneous or cooperative; in some cases, small size reflects prior heterogeneity and conflict.

Small size, then, does not guarantee homogeneity. Even if it did, the implications of size and homogeneity for collective action are not clear without the consideration of additional factors. Smaller groups are also handicapped by limited access to the resources needed for effective collective action. As group size drops, the levels of interaction that generate trust and facilitate collective action increase, but the resources available for mobilization decrease. What do these countervailing pressures imply for the relationship between group size and collective action?

Very small communities in the Kumaon Hills of India develop rules for management of their forest, engage in mutual monitoring, and enforce their rules through social sanctions. These arrangements for self-governance, however, do not guarantee that a community can defend its forest resources from encroachment from other communities or takeover by state agencies (Agrawal, 2000). Communities can protect their forests against rule violations by both community members and outsiders by hiring forest guards. To be effective, guarding must continue over a period of several months. The ability of a community to raise resources affects

not only its capacity to hire a guard but also the duration of guarding. The smallest communities in the Kumaon Hills had less success in raising the resources needed to hire guards for several months every year than did somewhat larger communities (ibid.: 74). In these villages, a curvilinear relationship emerges between group size and effective collective action for forest management.

Homogeneity and size of groups affect prospects for collective action, but not in a straightforward manner. Group size affects trust, predictability, and the ability to mobilize resources in different ways; the nature of its relationship with collective action probably depends on the importance of trust and predictability relative to resource mobilization in particular contexts. Homogeneity becomes important when it influences the distribution of interests in collective action, as in the empirical cases discussed above, or the ability to mobilize resources.

Reaffirming the Importance of Institutions

These IFRI studies from Ecuador, Guatemala, India, southern Indiana, and Uganda thus suggest that the perceived value of a resource is the most important condition affecting the emergence and success of institutions for self-governance. Attributes of the resource influence perceptions of values associated with the forest. The necessity of perceived value as a motivation for collective action underlines the importance of information. Reliable indicators of not only the condition of the forest, but also of links between the forest and its indirect services, emerge as especially important.

High appraisals of the forest's value provide a motivation for collective action, but do not guarantee collective action or its success. Collective action is costly. In addition to obtaining information, actors must overcome coordination problems, distributional struggles, and the incentive problems associated with common pool resources. Characteristics of groups, such as

their size and degree of homogeneity, gain importance because they influence the severity of coordination problems and distributional struggles. Predictability of interactions, for instance, aids coordination. Shared or complementary interests reduce the severity of distributional struggles. How size and homogeneity affect predictability and the distribution of interests appears to be contextually driven. Rather than having independent linear relationships with collective action, the importance of specific attributes of groups may depend on configurations of other attributes of the resource and resource users.

Once established, institutions alter the importance of conditions that affect their survival. Institutions limit the effects of population pressure (Agrawal and Yadama, 1997), population growth (Varughese, 1999), and variable proximity to forest resources (Varughese and Ostrom, 2001; Varughese, 1999). Institutions also direct the evolution of forms of heterogeneity that affect levels of trust, the predictability of interactions, and interests in collective action. In southern Indiana, institutions affect forest management by shaping the evolution of noneconomic preferences among community members (Gibson and Koontz, 1998). When economic change generates economic differentiation, interests in resource management may grow more diverse as well, potentially undermining the coalition behind collective arrangements for resource management.[10] Institutions that govern the distribution of resources within a community affect the pace of differentiation associated with economic change.[11]

External recognition and support for local self-governance lowers transaction costs. If the benefits of mobilization are high enough, a community may develop rules for resource management in the absence of external support (Ghate, 2000). Official recognition of local

[10] An anthropological study by Ensminger (1992) documented this process in Kenya.
[11] In Japan, historical rules for recognition of households even discouraged population growth (McKean, 1992: 75). Communities do not always succeed in developing institutions that moderate the obstacles to collective action arising from internal characteristics. In fact, some institutions and cultures exacerbate problematic characteristics (see Ruttan and Borgerhoff Mulder, 1999; Henrich, 2000).

autonomy lowers the transaction costs of self-governance (Banana and Gombya-Ssembajjwe, 2000). It also lowers the threshold of perceived benefits that must be overcome to achieve collective action and increases the local community's ability to capture the gains from cooperation.[12]

Where To From Here?

Considerable progress has been made on understanding the role of institutions for forest conditions. From developing lists of important variables and indicators, we are now moving towards a better understanding of the relative importance of these variables and the nonlinear and sometimes configurative relationships among them. Challenges remain. Some long-recognized challenges include the need for more cases, the need for studies of the same institutions over time, and the difficulty of comparing forests. Progress introduces new challenges, such as the need for more sophisticated analytical techniques to evaluate complex, dynamic, nonlinear relations.

Whatever the technique used, confidence in statistical relationships increases with the number of cases included in the analysis. Organization as an international network of CRCs contributing to a common database enables IFRI to draw upon a relatively large set of comparable cases. The need for a large number of cases is especially challenging for research on natural resources such as forests because differences across ecological zones limit comparability. The characteristics of a healthy forest differ with rainfall, altitude, aspect, and other ecological conditions. Even within a single ecological zone, comparisons of forest features are fraught with conceptual difficulties. Although biodiversity is desirable, for example, local species diversity may reflect the edge effects associated with forest disturbance rather than forest health.

[12] Compare Ensminger (1992).

We must also be able to compare sites in different forest biomes if we are to overcome the analytical limitations of small sample sizes. The ability to compare forests also helps to resolve questions about the effect of forest conditions on institutions, and the effect of institutions on forest conditions. IFRI adopts two strategies for overcoming this challenge: collection of data of perceived forest conditions, and the accumulation of time-series data for IFRI sites.

In the absence of clear and objective indicators of forest health,[13] perceptions of forest conditions by local users and by trained foresters offer a potential proxy. Perceptions of forest conditions by local users may predict institutional development better than actual forest conditions, since local action depends on perceived benefits from the forest and threats to them. Using perceptions of forest conditions to understand the effectiveness of management efforts, however, requires confidence that the perceived forest conditions by local users have a predictable relationship with objective forest conditions.

Different people, of course, evaluate forest conditions from distinctive perspectives.[14] The training of professional foresters hones their attentiveness to plant diseases, insects, erosion, parasitic or invasive plants, and the requirements for regeneration of particular species. Forestry also emphasizes the value of forests for timber production rather than subsistence. The forester's perceptions of forest health therefore reflect the potential for timber production, as well as signs of general threats to forest health. People who use the forest for subsistence, on the other hand, care less about timber species than the health of species with subsistence values, those that bear fruits and nuts, have medicinal uses, provide fodder, are good for building or firewood, and so

[13] Recognition of ecological diversity led those developing criteria and indicators for sustainable forest management to operate largely on a regional or eco-regional scale. The tension between the desire for internationally comparable data and the need for contextually appropriate indicators has not been resolved.

[14] We do ask for several broad evaluations of forest conditions in an IFRI site from the professional forester or biologist on a team as well as each of the user groups that make use of a forest. Varughese (1999) uses both the forester's and the users' perceptions of forest conditions in his study of 18 forests in Nepal. He could not use the results of forest mensuration as the forest composition changes sufficiently by altitude that measures derived from the random sample of plots taken in each forests are not comparable across the full 18 sites.

forth. Their evaluations of forest conditions inevitably stress the availability of valued subsistence species (e.g., Agrawal and Yadama, 1997). Assessments of forest condition may differ even within a community, if subpopulations use different forest resources.

Different bases for forest assessment represent challenges for analysis, but not insurmountable problems. Agreement among forest assessments by people with diverse backgrounds reinforces confidence that perceived conditions reflect actual conditions. In the event of strong disagreement, one might suspect that forest health is mixed, with some species doing better than others. These suspicions can be checked against forest mensuration data.

The relativistic aspect of perceived forest conditions represents a more serious challenge for comparative research. Decisions about whether a forest is in good health, or whether its conditions are improving or worsening, involve implicit comparisons. A forester's assessment of conditions in a particular forest reflects comparisons with an array of other forests encountered during the course of a career, sometimes in different ecological zones. Local populations, depending on their mobility, are generally familiar with a more constrained set of forests, but they have witnessed the evolution of those forests over many years. Their assessments involve comparisons with their own forest in other periods, as well as comparisons with neighboring forests now and in the past.

When using perceptions of forest conditions as an independent variable in explanations of collective action and institutional development, the relativistic nature of those perceptions can be treated as exogenous. This becomes a problem when we want to assess the consequences of institutions for actual forest conditions and use perceptions as a proxy for actual conditions. Time-series analysis allows comparisons of biophysical indicators and perceptions of forest conditions. Repeat studies of six sites in Nepal suggest that perceived changes reflect measured changes in forest condition (e.g., dbh, basal area, and species composition), although the sample

size is too small to be conclusive (Varughese, 1999: appendix).[15] With the accumulation of repeat studies in several parts of the world, the internal validity of these measures can be evaluated more rigorously. In the absence of repeat studies, similar comparisons can be drawn between aerial photos of forest conditions over time and perceptions of change in forest conditions. A third option involves comparisons of perceived forest conditions for neighboring sites with comparable biophysical indicators of forest health. All three of these options are feasible using IFRI data and are currently being pursued by IFRI researchers.

Conclusions

The dire predictions that most tropical forests "will be entirely lost or reduced to small fragments by early in the next century" (Task Force on Global Biodiversity, 1989) appear to be overly pessimistic. On the other hand, the solutions that have repeatedly been called for—international agreements, creation of natural preserves and parks, and massive donor assistance—are not working effectively either to preserve forests or to enhance the economic livelihoods of those dependent on forests (Sayer et al., 2000). One finds an immense variety of local circumstances that affect whether local forest users have organized themselves collectively to be the long-term stewards of their forests. While many local success stories exist, all too many forests have suffered severe degradation at the hands of those highly dependent on nearby forest resources (see, e.g., Campbell et al., 2001; Gibson and Becker, 2000).

[15] In his appendix, Varughese (1999) examines the relationship between users' perceptions of the change in forest conditions with data about stems per hectare, diameter at breast height, and species richness for trees, saplings, and shrubs for six forests where forest plot data was twice collected—four years apart. For five of the forests, the users' perception of forest change and the forest mensuration data were highly correlated. Users seem to be most aware of tree density and species richness. For one site, users were keenly aware of recent encroachments that were clearly visible to all who lived in a nearby forest, while the encroachment was not large enough to be reflected in the data obtained from a random sample of plots.

Many forest management policies have been adopted without consulting prior research on the factors that are associated with successful forest management by national, regional, or local governments or by local forest groups themselves. Consistent findings are now emerging from IFRI studies in diverse regions of the world that provide general support for an evolving theory of collective action related to forest resources (see Gibson, McKean, and Ostrom, 2000; Ostrom, 1998b). We have certainly established that common-property regimes are not simply a "relic" of earlier primitive institutions (McKean and Ostrom, 1995). On the other hand, the data clearly indicate that forest users are not all helplessly trapped in continued overuse of forest resources.

When local users, who have the authority to make local policies, expect that the *perceived benefits* of a sustained long-term harvesting pattern, more diverse forest products, a better water supply, and lowered erosion, outweigh the *perceived costs* they will have to pay in terms of the time and effort devoted to local organization and coping with formal legal bodies at multiple levels, a higher probability exists that workable institutions will be developed over time. Many factors affect perceptions of these benefits and costs. Rarely are these factors combined in a simple, linear fashion. The IFRI studies reviewed in this chapter emphasize that collective action for forest management hinges on *perceived* benefits of institutional development for resource management, dependence of local users on forest resources, and either *de facto* local autonomy or external backing for local decision making. Group size and heterogeneity also affect prospects for sustainable forest management. IFRI researchers have found important interaction effects between institutional design, group size, and other group characteristics; as a result, the influence of group size and heterogeneity upon collective action for forest management is neither uniform nor linear.

Further, those who exercise authority in a community may not share the same interests in forest sustainability as others in the community. Thus, the rules used for making policies (both

informal and formal rules) are themselves major factors that affect whether better rules will be chosen no matter whether the forest is managed by a national, regional, or local government or by the forest users themselves. National policies that enhance the capabilities of local users to create institutions that have legal standing, that provide reliable information about the effect of diverse management strategies, and that back up local monitoring, sanctioning, and conflict-resolution mechanisms are important vehicles for improving forest conditions in many countries over time.

Works Cited

Agrawal, Arun. 1995. "Population Pressure = Forest Degradation: An Oversimplistic Equation?" *Unasylva* 181(46):50-58.

_____. 2000. "Small Is Beautiful, But Is Larger Better? Forest-Management Institutions in the Kumaon Himalaya, India." In *People and Forests: Communities, Institutions, and Governance,* ed. Clark C. Gibson, Margaret A. McKean, and Elinor Ostrom, 57-85. Cambridge, MA: MIT Press.

_____. 2001. "Common Property Institutions and Sustainable Governance of Resources." *World Development* 29(10) (October): 1623-48.

_____. 2002. "Common Resources and Institutional Sustainability." in *The Drama of the Commons,* ed. Elinor Ostrom, Thomas Dietz, Nives Dolšak, Paul C. Stern, Susan Stonich, and Elke U. Weber, Committee on Human Dimensions of Global Change. Washington, DC: National Academy Press, forthcoming.

Agrawal, Arun, and Clark C. Gibson. 1999. "Enchantment and Disenchantment: The Role of Community in Natural Resource Conservation." *World Development* 27(4) (April): 629-49.

Agrawal, Arun, and Clark C. Gibson, eds. 2001. *Communities and the Environment: Ethnicity, Gender, and the State in Community-Based Conservation*. New Brunswick, NJ: Rutgers University Press.

Agrawal, Arun, and Gautam N. Yadama. 1997. "How do Local Institutions Mediate Market and Population Pressures on Resources? Forest *Panchayats* in Kumaon, India." *Development and Change* 28(3) (July): 435-65.

Baland, Jean-Marie, and Jean-Philippe Platteau. 2000. *Halting Degradation of Natural Resources: Is There a Role for Rural Communities?* New York: Oxford University Press.

Banana, Abwoli Y., and William Gombya-Ssembajjwe. 2000. "Successful Forest Management: The Importance of Security of Tenure and Rule Enforcement in Ugandan Forests." In *People and Forests: Communities, Institutions, and Governance,* ed. Clark C. Gibson, Margaret A. McKean, and Elinor Ostrom, 87-98. Cambridge, MA: MIT Press.

Becker, C. Dustin. 1999. "Protecting a *Garua* Forest in Ecuador: The Role of Institutions and Ecosystem Valuation." *Ambio* 28(2) (March): 156-61.

Becker, C. Dustin, Abwoli Y. Banana, and William Gombya-Ssembajjwe. 1995. "Early Detection of Tropical Forest Degradation: An IFRI Pilot Study in Uganda." *Environmental Conservation* 22(1) (Spring): 31-38.

Boserup, Esther. 1965. *The Conditions of Agricultural Growth: The Economics of Agrarian Change under Population Pressure*. London: Allen & Unwin.

Campbell, Bruce, Alois Mandondo, Nontokozo Nemarundwe, and Bevlyne Sithole. 2001. "Challenges to Proponents of Common Property Resource Systems: Despairing Voices from the Social Forests of Zimbabwe." *World Development* 29(4):589-600.

Ensminger, Jean. 1992. *Making a Market: The Institutional Transformation of an African Society*. Cambridge and New York: Cambridge University Press.

Fairhead, James, and Melissa Leach. 1996. *Misreading the African Landscape: Society and Ecology in a Forest-Savanna Mosaic.* Cambridge University, African Studies Center, African Studies Series 90. Cambridge and New York: Cambridge University Press.

FAO. 2001. *State of the World's Forests 2001*. Rome: Food and Agriculture Organization (FAO) of the United Nations.

Fearon, James D., and David D. Laitin. 1996. "Explaining Interethnic Cooperation." *American Political Science Review* 90(4) (December): 715-35.

Fox, Jefferson. 1993. "Forest Resources in a Nepali Village in 1980 and 1990: The Positive Influence of Population Growth." *Mountain Research and Development* 13(1):89-98.

Ghate, Rucha. 2000. "The Role of Autonomy in Self-Organizing Processes: A Case Study of Local Forest Management in India." Working Paper. Bloomington: Indiana University, Workshop in Political Theory and Policy Analysis.

Gibson, Clark. 2001. "Forest Resources: Institutions for Local Governance in Guatemala." In *Protecting the Commons: A Framework for Resource Management in the Americas,* ed. Joanna Burger, Elinor Ostrom, Richard B. Norgaard, David Policansky, and Bernard D. Goldstein, 71-89. Washington, D.C.: Island Press.

Gibson, Clark C., and C. Dustin Becker. 2000. "A Lack of Institutional Demand: Why a Strong Local Community in Western Ecuador Fails to Protect Its Forest." In *People and Forests: Communities, Institutions, and Governance,* ed. Clark C. Gibson, Margaret A. McKean, and Elinor Ostrom, 135-61. Cambridge, MA: MIT Press.

Gibson, Clark C., and Tomas Koontz. 1998. "When 'Community' is Not Enough: Institutions and Values in Community-Based Forest Management in Southern Indiana." *Human Ecology* 26(4):621-47.

Gibson, Clark C., Margaret A. McKean, and Elinor Ostrom, eds. 2000. *People and Forests: Communities, Institutions, and Governance*. Cambridge, MA: MIT Press.

Gibson, Clark C., Fabrice E. Lehoucq, and John T. Williams. Forthcoming. "Does Tenure Matter to Resource Management? Property Rights and Forests in Guatemala." *Social Science Quarterly.*

Gibson, Clark, Elinor Ostrom, and T. K. Ahn. 2000. "The Concept of Scale and the Human Dimensions of Global Change: A Survey." *Ecological Economics* 32(2) (February): 217-39.

Gombya-Ssembajjwe, William. 1999. "Institutions and Sustainable Forest Management." *The Uganda Journal* 45 (August): 51-60.

Hardin, Russell. 1982. *Collective Action*. Baltimore, MD: Johns Hopkins University Press.

Henrich, Joseph. 2000. "Does Culture Matter in Economic Behavior?" *American Economic Review* 90(4):973-79.

Kaimowitz, David, and Arild Angelsen. 1998. *Economic Models of Tropical Deforestation. A Review.* Bogor, Indonesia: CIFOR.

McKean, Margaret A. 1992. "Management of Traditional Common Lands (*Iriaichi*) in Japan." In *Making the Commons Work: Theory, Practice, and Policy,* ed. Daniel Bromley et al., 63-98. San Francisco, CA: ICS Press.

McKean, Margaret A., and Elinor Ostrom. 1995. "Common Property Regimes in the Forest: Just a Relic From the Past?." *Unasylva* 46(180) (January): 3-15.

Mertens, Benoit, William D. Sunderlin, Ousseynou Ndoye, and Eric F. Lambin. 2000. "Impact of Macroeconomic Change on Deforestation in South Cameroon: Integration of Household Survey and Remotely-Sensed Data." *World Development* 28(6):983-99.

Olson, Mancur. 1965. *The Logic of Collective Action: Public Goods and the Theory of Groups*. Cambridge, MA: Harvard University Press.

Ostrom, Elinor. 1992. "The Rudiments of a Theory of the Origins, Survival, and Performance of Common-Property Institutions." In Daniel W. Bromley et al., eds. *Making the Commons Work: Theory, Practice, and Policy*, 293-318. San Francisco, CA: ICS Press.

_____. 1998a. "The International Forestry Resources and Institutions Research Program: A Methodology for Relating Human Incentives and Actions on Forest Cover and Biodiversity." In *Forest Biodiversity in North Central and South America, and the Caribbean: Research and Monitoring,* ed. F. Dallmeier and J. A. Comiskey, 1-28. Man and the Biosphere Series, vol. 21. Paris: UNESCO; New York: Parthenon.

_____. 1998b. "Scales, Polycentricity, and Incentives: Designing Complexity to Govern Complexity." In *Protection of Global Biodiversity: Converging Strategies,* ed. Lakshman D. Guruswamy and Jeffrey A. McNeely, 149-67. Durham, NC: Duke University Press.

_____. 1999. "Self-Governance and Forest Resources." CIFOR Occasional Paper no. 20. Bogor, Indonesia: Center for International Forestry Research (CIFOR).

Ostrom, Elinor. 2001. "Decentralization and Development: The New Panacea." In *Challenges to Democracy: Ideas, Involvement and Institutions* (The PSA Yearbook 2000), ed. Keith Dowding, James Hughes, and Helen Margetts, 237-56. New York: Palgrave.

Ostrom, Elinor, Joanna Burger, Christopher Field, Richard B. Norgaard, and David Policansky. 1999. "Revisiting the Commons: Local Lessons, Global Challenges." *Science* 284(5412) (April 9): 278-82.

Prabhu, Ravi, Carol J. P. Colfer, and Richard G. Dudley. 1999. *Guidelines for Developing, Testing and Selecting Criteria and Indicators for Sustainable Forest Management: A C&I Developer's Reference.* No. 1 in The Criteria & Indicators Series. Jakarta, Indonesia: Center for International Forestry Research (CIFOR).

Rudel, Thomas. 1994. "Population, Development, and Tropical Deforestation: A Cross-National Study." In *The Causes of Tropical Deforestation,* ed. Katrina Brown and David W. Pearse, 96-105. Vancouver: UBC Press.

Ruttan, Lore M., and Monique Borgerhoff Mulder. 1999. "Are East African Pastoralists Truly Conservationists?" *Current Anthropology* 40(5) (December): 621-52.

Sayer, Jeffrey A., et al. 2000. "World Heritage Forests. The World Heritage Convention as a Mechanism for Conserving Tropical Forest Biodiversity." Bogor, Indonesia: CIFOR, Government of Indonesia, UNESCO.

Schweik, Charles M., Keshav Adhikari, and Kala Nidhi Pandit. 1997. "Land-Cover Change and Forest Institutions: A Comparison of Two Sub-Basins in the Southern Siwalik Hills of Nepal." *Mountain Research and Development* 17(2) (May): 99-116.

Sekher, Madhushree. 2000. "Local Organizations and Participatory CPR Management: Some Reflections." Bangalore, India: Institute for Social and Economic Change.

Task Force on Global Biodiversity. 1989. *Loss of Biological Diversity: A Global Crisis Requiring International Solutions*. Washington, D.C.: National Science Board.

Tucker, Catherine M. 1999. "Private Versus Common Property Forests: Forest Conditions and Tenure in a Honduran Community." *Human Ecology* 27(2): 201-30.

Varughese, George. 1999. "Villagers, Bureaucrats, and Forests in Nepal: Designing Governance for a Complex Resource." Ph.D. diss. Bloomington: Indiana University.

_____. 2000. "Population and Forest Dynamics in the Hills of Nepal: Institutional Remedies by Rural Communities." In *People and Forests: Communities, Institutions, and Governance,* ed. Clark C. Gibson, Margaret A. McKean, and Elinor Ostrom, 193-226. Cambridge, MA: MIT Press.

Varughese, George, and Elinor Ostrom. 2001. "The Contested Role of Heterogeneity in Collective Action: Some Evidence from Community Forestry in Nepal." *World Development* 29(5):747-65.

Wily, Liz, and Sue Mbaya. 2001. *Land, People and Forests in Eastern and Southern Africa at the Beginning of the 21st Century*. International Union for the Conservation of Nature.