



CIFOR's research on forest tenure and rights

Krister Andersson



Report

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Krister Andersson
University of Colorado at Boulder

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Chibaya village, Mpika District, a site of CIFOR's research into biofuels. Zambia, June, 2010.

CIFOR
Jl. CIFOR, Situ Gede
Bogor Barat 16115
Indonesia

T +62 (251) 8622-622
F +62 (251) 8622-100
E cifor@cgiar.org

cifor.org

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Table of contents

1. Introduction	1
2. Conceptual definitions and clarifications	2
3. CIFOR's core contributions to the state of knowledge about forest tenure and rights	5
3.1 Insecure property rights undermine sustainable forest use	5
3.2 Understanding property rights is critical for good policy analysis	6
3.3 The transition towards more community ownership of forests poses new demands on research	6
4. Unanswered questions on forest tenure and rights	6
4.1 The politics of forest tenure reform	7
4.2 When does tenure reform increase tenure security?	7
4.3 What institutional factors contribute to more secure forest tenure?	8
4.4 What is the role of government in the community governance of forest property rights systems?	8
4.5 Under which conditions will secure forest tenure promote socially equitable and ecologically sustainable outcomes?	8
4.6 What methodologies will effectively advance the field of forest tenure and property rights?	8
4.7 Meeting the demands of a changing policy world	9
5. Criteria for review of CIFOR's work	9
6. Results	10
6.1 Addressing existing knowledge gaps	10
6.2 Contributing to cumulative knowledge by using or building shared data sets	10
6.3 Research design, methods, and data that allow for causal inference	10
6.4 Policy relevance	11
6.5 Impact on research	11
7. Discussion	12
8. Conclusion	13
9. References	14
Appendices	
A. CIFOR studies on forest tenure and rights	16
B. CIFOR studies performance indicators	19

List of figures and tables

Figures

1. A framework for linking policy, property rights, and governance outcomes 2
2. Regional distribution of CIFOR studies on forest tenure and rights 3
3. Do CIFOR publications address the identified knowledge gaps? 8
4. Do CIFOR studies use or build shared data sets? 8
5. To what extent is causal inference feasible in CIFOR research? 9
6. Does CIFOR research address urgent policy needs? 9
7. Citations of CIFOR forestry studies per year 9

Table

1. Levels of governance and rule-making 1

1. Introduction

One of the core findings in the literature on natural resource governance is that institutional arrangements and property rights are key to understanding why some groups and communities of resource users perform better than others, in terms of changes in both livelihoods and resource conditions. The significance of institutional arrangements and property rights at multiple levels is that they critically influence decision making related to resource use, including efforts to regulate access to and consumption of resources.

In CIFOR's quest to develop new knowledge about how to alleviate poverty among forest-dependent people, the analysis of institutional arrangements for collective action and property rights has been made a high priority in the organization's research agenda. CIFOR's strategy for 2008–2018 makes this commitment clear when it states that CIFOR aspires to 'become a leading source of information and analysis on the relationships among forests, poverty and the environment, and how management and governance arrangements affect livelihood and conservation outcomes' (CIFOR 2008: 10).

Although the strategy is very recent, CIFOR has already established itself at the forefront of this area of research, making several significant contributions to new knowledge about how property rights, tenure security, institutional arrangements, and governance outcomes are related at various scales. Among these is the demonstration of how important tenure security is for any effort that seeks to improve livelihood and resource condition outcomes for socio-ecological systems (Molnar *et al.* 2008; Larson *et al.* 2008; Pacheco *et al.* 2008) and the factors that are associated with the establishment of secure property rights.

The policy context is changing rapidly, however, and new issues and challenges are emerging continuously. A major forest tenure transition is underway in which an increased proportion of the world's forest is now controlled by rural communities and indigenous groups—at least on paper (White and Martin 2002; Sunderlin *et al.* 2008). Rights-based approaches to forest governance are becoming increasingly popular in policy analysis and practice (e.g., Johnson and Forsyth 2002; Campese *et al.* 2009). New challenges have emerged for forest-adjacent and forest-dwelling

people who struggle for greater tenure security amidst expanding industrial agriculture, biofuel production, and carbon trading. CIFOR needs to adapt its research agenda to meet the shifting demands for relevant knowledge.

CIFOR's research strategy, which outlines the priority focus areas for its work until 2018, emphasizes the need to continuously adapt in order to stay relevant in a changing world. For research on forest governance, this means that there is a need for a systematic, global comparative research program on property rights and tenure that produces knowledge that can inform public policy choices so that forest-dependent people can increase the benefits they are able to derive from their use of forests.

In its efforts to make sure its research in this area stays relevant and on the cutting edge, CIFOR has commissioned this review. The specific purpose of the review is to assess the relevance, rigor and robustness of CIFOR's existing research on property rights and tenure and identify emerging questions that CIFOR research ought to address in the future. To meet this objective, the consultant examined several aspects of CIFOR's work, including questions related to tenure that CIFOR research has already addressed, how well these have been answered, and what is missing from CIFOR research, including what other researchers outside CIFOR have done on forest tenure.

The review resulted in the following findings:

1. CIFOR's work on forest tenure and property rights would benefit from conceptual development and diversification and should include more work that goes beyond a pure rights-based approach.
2. One way of strengthening CIFOR's research would be to diversify its methodological orientation to encourage its researchers to strengthen existing efforts to test causal claims through robust comparative analysis, regardless of whether qualitative or quantitative methods are used.
3. At least six areas of research are currently underexplored by most researchers concerned with forest governance. As a consequence, decision making in many of these areas is unsupported by evidence from research. CIFOR has an opportunity to take the lead in addressing these issues.

4. Empirical analysis of CIFOR's research on forest tenure shows mixed performance outcomes. While the organization excels in its commitment to policy-relevant research, it shows less impressive performance in other critical areas of its research on forest tenure and rights.

The report is structured in the following manner. Following this introduction, it maps out and clarifies central concepts and the relationships between them. Based on the existing literature's identification of knowledge gaps, six largely unanswered research questions are identified. Next, five evaluative criteria are derived from CIFOR's Strategy 2008–2018 and applied to all 53 CIFOR publications on forest tenure and rights. The results of the empirical assessment are then presented and discussed, followed by a conclusion.

2. Conceptual definitions and clarifications

Several alternative definitions of property rights exist.¹ Because of its wider applicability to the area of natural resource governance, this review will employ Bromley's definition: 'the capacity to call upon the collective to stand behind one's claim to a benefit stream' (Bromley 1991). Although Bromley refers primarily to the state as representing the collective, here the term is used more broadly and can in some cases include non-state actors as well.

The benefit streams that make up property rights to natural resources have been characterized in a number of ways. An approach that has received widespread acceptance is the characterization of property rights as bundles of rights. Schlager and Ostrom (1992) distinguish between five bundles of rights that are frequently allocated as part of any given property right system:

1. *Access rights*—the right to enter a resource and enjoy the non-subtractive benefits generated by the resource such as clean air, beauty, or a place to exercise.
2. *Harvesting rights*—the right to withdraw specific quantities of resource units such as fish, trees,

non-timber forest products or water, sometimes at specific times and locations.

3. *Management rights*—the right to define rules related to maintenance of the resource and/or to physically change the structure of the resource (such as pulling out invasive species, cleaning the canals of an irrigation system or building related facilities).
4. *Exclusion rights*—the right to determine who has any of the above three rights.
5. *Alienation rights*—the right to sell, bequeath, or otherwise transfer any or all of the above rights.

Based largely on empirical observation, property right bundles generally become larger in the numerical sequence indicated above, with the smallest bundle including only access rights, and the largest bundle including all five types of rights.

Such characterizations implicitly invoke different sets of rules or institutional arrangements that underpin the property rights. That is, there are specific rules associated with each bundle of rights. These rules define the content of the property right—what holders and non-holders may, may not or must do with regards to a resource's benefit stream (e.g., Haley and Luckert 1990). Rules specify the scope of the rights, the responsibilities associated with resource use to which one holds rights, the consequences for non-compliance, and the procedure for contestation of rights. The realization that property rights are conditioned by specific rules highlights that bundles of rights are associated with corresponding bundles of responsibilities.

In short, it is productive to view property rights as benefit streams that are conditioned by rules. The reason is simple: The rules, or institutional arrangements, not only define property rights but also affect benefit streams. Property rights rules may govern, for example, duration (how long rights may be exercised), exclusiveness (who may be excluded from the benefit stream), transferability (how the rights can be sold), zoning (whether land uses can be changed), comprehensiveness (which natural resources are included in the rights) and operational requirements (concerning harvesting, management and processing). By specifying these types of rules, the content of the property rights is characterized in a way that lends itself to explaining behaviour among resource users on the ground.

¹ Much of this section builds on conceptual analysis in Andersson *et al.* (2009).

Two specific aspects of such rules help us understand how rights influence resource user behaviour. The first is the degree to which the rules are actually observed by the resource users. Making a distinction between *rules-in-use* (which are generally accepted as legitimate by resource users on the ground, such as customary rules and norms) and *rules-in-form* (which exist on paper but do not constrain resource users' behaviour) requires the analyst to go beyond a superficial study of rules on the books and find out the extent to which such rules actually make a difference for people's behaviour on the ground. If the rules behind the rights are rules-in-use, those rights are called *de facto* rights. If the rules are formalized and perhaps even codified into national law, *de jure* rights exist. In some instances, when rules-in-use coincide with the formal rules on the books, there is no difference between *de jure* and *de facto* rights. (Rules-in-use may be formal or informal, while rules-in-form are always formal.) The significance of this distinction is that applying it to each bundle of rights enables the analyst to explain observed user behaviour, which in turn will serve to inform the discussion of what alternative institutional arrangements might produce better outcomes.

The second aspect of rules that increase analytical leverage is the specification of the governance levels that determine a given rule. Most institutional scholars recognize three levels of governance: operational, collective choice, and constitutional. Table 1 describes these levels. This specification helps the analyst to think about the procedure by which a given rule may be modified, and which actors need to agree on such a rule change. Making this

explicit is important for assessing the difficulty and likelihood of modifying the existing rules associated with property rights. Analysis that focuses on both rules-in-use and the multiple levels of governance and how they are linked helps us to understand how policy reforms may or may not lead to real changes in behaviour among resource users in specific contexts.

But the content of property rights is rarely a static phenomenon. Property rights change as rules (and other factors) change through policy reform processes such as land reform and decentralization. The changes that operational rules undergo are subject to the governance structures that are in place. That is, constitutional/collective choice rules provide the rights to change property rights rules, which in turn change the rights themselves. Therefore, considerations of local property rights to forest resources need to go beyond understanding the content of property rights, embodied in a given set of rules, to understanding the dynamic context in which policy and constitutional rules allow property rights to evolve. This last point is important in that it raises the issue of how the state and formal governmental organizations affect the governance of property rights systems—an issue that is rarely addressed in the literature on community-based natural resource management: What is the role of the state in community forest governance? This report will return to this question in the section about unanswered research questions below.

As property rights change, the security, or assurance, of those rights may be affected (Sjaastad and Bromley 2000). Changing operational rules may

Table 1. Levels of governance and rule-making

Level of governance	Rules affecting action arenas	Examples of decisions	Examples of actors
Constitutional (highest level)	Defines the decision-making process at the collective choice level	Modifications of property-rights system, forestry policy, customary rules and norms	Village elders, elected officials, spiritual leaders, heads of government, state
Collective choice (policy)	Procedural rules that govern the processes that define and change operational rules	Property rights, logging permit requirements, land use zoning requirements, forest management plans	Natural resource managers, community assemblies, village councils, government agency personnel, resource users
Operational	Rules that define the format and content of day-to-day activities	Forest management plans, property rights, harvesting regulations, monitoring assignments	Resource users, resource managers, monitors, law enforcement officials

Sources: author's elaboration based on Andersson *et al.* (2009), Gibson, Ostrom and Williams (2005) and Ostrom (1999)

increase, decrease, or have a neutral effect on benefit streams. Insecure property rights give their holders little confidence in maintaining benefit streams over time and can undermine incentives for managing forest resources (Luckert 1998). Therefore, in addition to considering the content of property rights, dictated by property rights rules, it is also important to consider the security of property rights, which are influenced by the collective choice rules that influence changes in these benefit streams. Moreover, as is the case for political behaviour, dynamic relationships between production behaviour and property rights also suggest interactive causality. That is, households may choose to undertake production activities in ways that increase the security of their property rights, such as investing in land improvements.

Recognizing the dynamics of property rights, it becomes clear that policy changes (such as land reform and decentralization) not only affect the benefits derived from existing resources but also influence the incentives that local people have to invest in future benefit streams. As households go about their production activities, they use various combinations of capital. The livelihoods approach (e.g., Ellis 1998) recognizes a number of different types of capital: natural (such as forest resources), human (such as education), physical (such as

implements), financial (such as savings) and social (such as the goodwill of neighbours). These accessible stores of wealth are largely responsible for defining the available choices for households as they undertake the production decisions that define the flows of goods and services that they derive. The choices that households make, in turn, influence the remaining capital stocks. Social capital plays a slightly different role, as we believe that such relationships among people more directly interact with political rather than production behaviour.

Another potentially important aspect of property rights is their clarity. Benefits derived from property rights occur within social settings where perceptions of rules may vary, at any given time, among community members. The larger the variation in perceptions of rules, the less clear are the property rights. The clarity of property rights may influence benefit streams in a similar manner as the security of those rights. Given that property rights may be interpreted as a claim on a benefit stream within a given social setting, a lack of consensus on rules can lead to confusion regarding who gets what from resources, and how the rules that influence these benefits can be changed. As a result, lack of clarity can undermine current and future benefits that flow from resources.

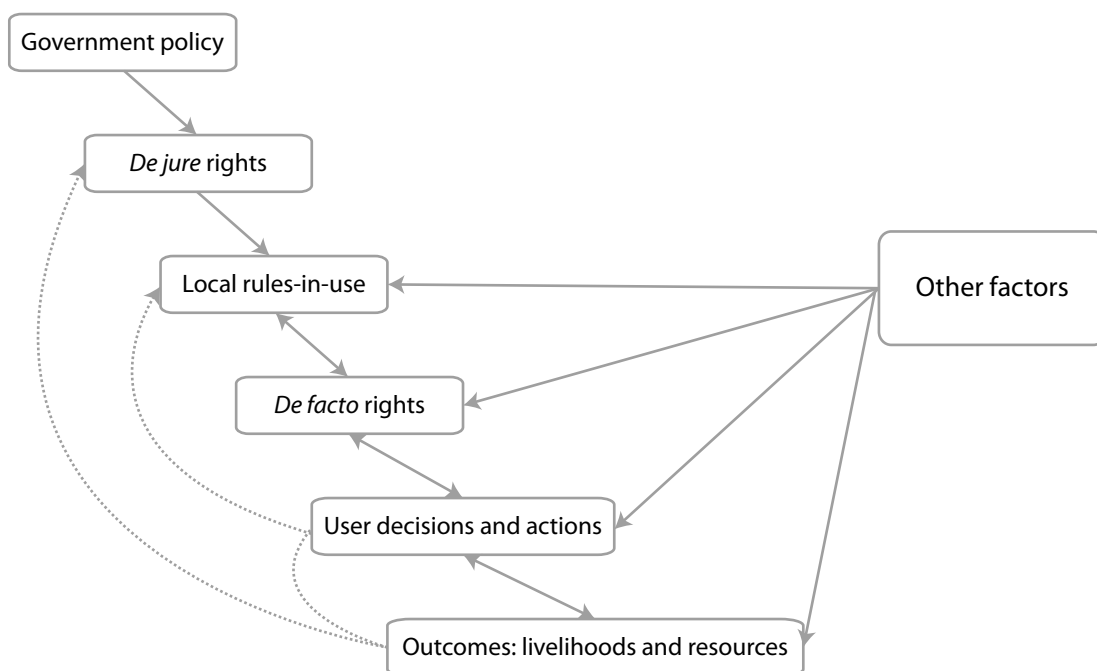


Figure 1. A framework for linking policy, property rights, and governance outcomes

Source: author's elaboration based on Andersson *et al.* (2009)

Attempting to represent these relationships graphically, a recent paper by Andersson *et al.* (2009) presents a framework similar to the one in Figure 1 below, in order to help the analyst to consider the many factors that link policy and reforms with on-the-ground impacts. Along these lines, the linkages in Figure 1 may help to explain the role of policy reforms in affecting livelihoods and resource conditions.

In sum, defining property rights in terms of content, security and clarity allows us to consider changes to benefits and management incentives that may result from changes in policy. At the operational level, these reforms may translate into changes in the content and clarity of property rights. At the collective choice level, governance reforms may translate into changes in the right to change rights, which may also influence the security of property rights.

3. CIFOR's core contributions to the state of knowledge about forest tenure and rights

Since 2000, CIFOR has published 53 studies that address, to varying degrees, issues related to forest tenure and property rights. These publications analyse a broad range of questions, covering issues from the historical evolution of forest tenure arrangements in China (Dachang 2001) to the effect of insecure property rights on deforestation in the Amazon (Kaimowitz 2002; Pacheco 2002), and to the challenge of embedded tenure institutions in Africa (Diaw 2005). Of these studies, 25 per cent are explicitly comparative in nature, exploring how the national and local context, including tenure arrangements, affect the governance of forest resources (Carter and Gronow 2005; Neumann and Hirsch 2000; Elliot 2000). Most of the studies published since 2000 have focused on Asia, followed by Latin America and Africa, as shown in Figure 2.

After reviewing those CIFOR studies that deal with forest tenure as the primary concern, several core findings emerge, each supported by multiple studies. Any synthesis of such an active and broad program is bound to be highly subjective. No doubt this synopsis has overlooked many important aspects of the chosen studies. Despite such limitations, however, it may still be useful for the organization

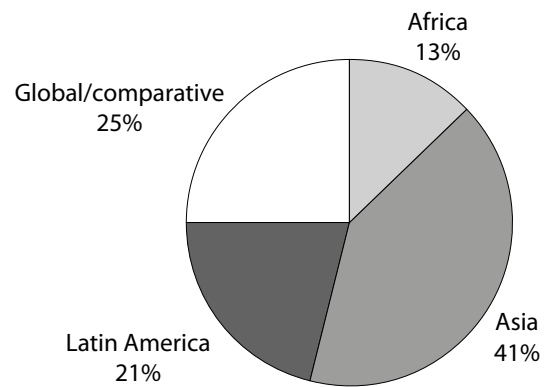


Figure 2. Regional distribution of CIFOR studies on forest tenure and rights

as it seeks to assess its impact on the current state of knowledge in this field. The assessment may also help in prioritizing future research questions. Its findings fit into three broad categories, discussed below.

3.1 Insecure property rights undermine sustainable forest use

The rationale for promoting increased rights to trees and forests for rural people is based not only on the need to uphold human rights but also on the need to strengthen individual incentives to invest in the resource. Hence, property rights reforms are justified on the basis of removing one of the most significant barriers to sustainable forest use: insecure forest tenure (Pacheco 2009; Larson *et al.* 2008).

Perhaps the most interesting outcome of this line of research is that it introduces a great deal of nuance into the debate about the ingredients of sustainable forest management. Mainstream research on sustainable forest management does not go into much detail about the interaction between improved tenure security and resource users' preferences; it is encouraging that CIFOR scholars have addressed this issue.

Pacheco (2009), for instance, observes in the case of Pará in Brazil that improved forest tenure through the agrarian reform has had vastly different effects on smallholders with diversified land uses (less deforestation) than on industrial agribusinesses and extensive cattle ranches (much more deforestation). Along the same lines, Angelsen (1999) notes that well-intentioned policy reforms, such as agrarian reforms and agricultural intensification programs,

can increase deforestation, especially on the agricultural frontier.

3.2 Understanding property rights is critical for good policy analysis

Public policy is ultimately about trying to correct unproductive behaviour by individuals and groups through the creation, monitoring and enforcement of rules. To do so effectively, policy makers need to target their policies to the specific factors that cause the undesirable behaviour in the first place. Such targeting, in turn, requires an understanding of the characteristics of those factors (Diaw *et al.* 2009). The purpose of policy analysis is precisely to help policy makers understand the drivers of resource users' behaviour on the ground. CIFOR's research (e.g., Spilisbury and Kaimowitz 2002; Pulhin *et al.* 2002) has shown that understanding forest tenure and property rights arrangements is critical in order to explain variations in local behaviour.

A problem facing public policy is that its formal rules and regulations are often imposed from above and ignore local contextual factors—such as biophysical attributes, socioeconomic characteristics, and social norms and rules-in-use of specific groups and their locations (Dahal and Adhikari 2009). This is one of the reasons for policy failures in forestry policy (Pacheco *et al.* 2008). Hence, solid policy analysis requires, among other things, attention to how local property rights and other institutional arrangements shape behaviour locally. Without an understanding of how local context influences individual and collective behaviour, policy analyses risk becoming highly disconnected from the reality faced by resource users on the ground.

3.3 The transition towards more community ownership of forests poses new demands on research

Several CIFOR studies have used a rights-based approach to argue for increased legal recognition of the inherent rights of forest-dwelling and forest-adjacent people to forest resources (e.g., Colchester 2002 and 2004; Molnar *et al.* 2008). But the organization's research agenda has not stopped there, as many CIFOR scholars have contributed to new knowledge about the implications of the on-going forest tenure transition, through

which more and more forests are controlled by rural communities and indigenous groups (White and Martin 2002; Nforti, 2000).

Other CIFOR scholars have pointed out that while the tenure transition is an important first step towards tenure security and sustainable forest management, it is merely one of several steps that are needed (e.g., Carter and Gronow 2005; Diaw 2005; Dachang 2001). Pacheco *et al.* (2008: 5) sum it up well when they state, 'in spite of the fact that many governments have introduced progressive policies intended to benefit rural populations and their forest use, it is questionable the extent to which such policies have actually brought about any real change to benefit communities.'

In areas where the transition has not just occurred on paper but has effectively changed property rights on the ground, one of the great challenges for researchers is to identify the conditions under which communities can take advantage of such rights and gain sustained improvements to both their livelihoods and the resource base (e.g., Larson *et al.* 2008; Barr *et al.* 2006).

CIFOR's three major findings have laid the foundation for future work on forest tenure and property rights. This work has shown, beyond any doubt, that this is an exciting area of research that has the potential to inform decision making at multiple levels—international, national and local—and in which much work remains to be done. The next section identifies some of the burning issues on which more research is needed.

4. Unanswered questions on forest tenure and rights

In an effort to assist CIFOR in identifying key issues and unanswered questions regarding forest tenure and property rights, this section reviews a few of the most recent and influential studies on forest governance and summarizes their expression of an emergent research agenda. The criterion used to identify these studies was the number of citations according to the search engine on ISI Web of Knowledge for the search terms 'forest tenure' and 'forest property rights'. The reviewer selected the ten most cited studies, published after 1999,

and examined the topics and questions that these studies suggested for future research. Referring to the identified topics for future research in these studies, the reviewer identified six gaps in knowledge that would merit increased attention among CIFOR researchers:

1. What political conditions are most conducive to forest tenure reform?
2. When does tenure reform increase tenure security?
3. What factors contribute to establishing more secure forest tenure?
4. What is the role of government in increasing forest tenure security?
5. Under what conditions does forest tenure lead to sustainability?
6. What methods provide the best analytical leverage for these areas of research?

4.1 The politics of forest tenure reform

The existing literature on forest tenure and rights emphasizes the need for increased recognition of the rights of local communities and smallholders. Normative research makes a case for the formalization of a full set of property rights for natural resource users to be able to access, manage and sell their rights and resources (Reeb and Romano 2007; White and Martin 2002). Such formalization of rights is often viewed as a basic condition for sustainable resource management (Colchester 2004; Molnar *et al.* 2008). Although several recent empirical studies have pointed out that the introduction of formal rights is hardly ever sufficient for achieving tenure security, most scholars do agree that establishing *de jure* recognition of local people's rights to access and use forest resources is an important first step (Shepherd 2008; Chaves 2008). Considerably less agreement exists regarding how to achieve that first step. Why do some governments choose to adopt tenure reform while others do not?

The reasons for adopting tenure reform are part of a political process that is not very well understood. Few studies analyse the conditions under which such reform policies are adopted. Even if such a reform is passed, and previously landless people are given considerable rights, tenure security may not automatically result. The achievement of tenure

security depends ultimately on how the governance of the tenure and rights system is carried out. CIFOR is in a position to go beyond the traditional rights-based approach to forest use and ask emerging questions about the political process behind adopting such reforms.

4.2 When does tenure reform increase tenure security?

One of the problems of tenure reform is that expanding the rights of certain groups in society often means diminishing the rights of others. Such a process generates winners and losers. If the losers are large landowners, who are often powerful in both economic and political terms, chances are that the reform will meet significant obstacles in its implementation.

A case in point is the land reform introduced in Brazil in the 1990s. This reform increased the rights of landless farmers substantially, but the reform process also led to an increase in uncertainty associated with the governance of the reform (Alston *et al.* 2000; Nepstad *et al.* 2002). According to Alston *et al.* (2000), this uncertainty carried a high price for society, with an increase in violent conflicts, accelerated deforestation, and overall less tenure security for both landless people and landowners. According to the authors, the uncertainty was produced by the interaction of three main factors: (1) inconsistencies between civil and constitutional law, (2) the unpredictability of court rulings interpreting the law, and (3) arbitrary implementation by the federal land reform agency, INCRA.

In other cases, the outcomes have been much more successful than in Brazil, and more equitable tenure rights have been established, which in turn has stabilized the system and increased forest tenure security for previously marginalized groups. Several countries have now carried out forest tenure reforms, with mixed results in terms of delivering increased tenure security for poor, forest-dependent rural populations. What drives such variation in outcomes? CIFOR would produce highly policy-relevant knowledge if it were to undertake such a comparative analysis.

4.3 What institutional factors contribute to more secure forest tenure?

The introduction of formal property rights is not enough to establish secure tenure. What institutional conditions are conducive to creating such security? Surprisingly little systematic empirical research has been carried out to address this question. Institutional scholars suggest that effective self-governance—including institutions for rule-making, monitoring and enforcement as well as sanctioning—is closely associated with the achievement of secure forest tenure and rights (Ostrom 1999; Andersson and Pacheco 2006), but the empirical evidence to support such propositions more generally is scant. Moreover, how can communities that do not have strong self-organized governance systems increase their tenure security? If strong self-governance is essential, how can local institutions be strengthened? What are the options for decision makers in local communities, government agencies, and international donors? These are just some of the unanswered policy questions related to the institutional foundations of tenure security that CIFOR research should address.

4.4 What is the role of government in the community governance of forest property rights systems?

One of the unfortunate and unintentional consequences of the success of scholarship on common property management is that nearly all research about community governance of natural resources, forest tenure and rights included, has focused on the local community sphere. Although common property scholars agree that extra-community organizations, such as government and NGOs, have a crucial role to play in supporting self-government, relatively little empirical work has been carried out to analyse these functions. A recent World Bank study observes that in cases where forest control is transferred to local communities, one way for government to support this process is to 'build local institutions with upward and downward accountability' (Chomitz *et al.* 2007: 178). While this recommendation seems to make a lot of sense intuitively, it is unclear how the external actors might do this. What exactly does local institution building entail? Which strategies have proven to be most effective? What is the role of the state? This research

area is wide open. CIFOR-sponsored research in this area would be both important and pioneering.

4.5 Under which conditions will secure forest tenure promote socially equitable and ecologically sustainable outcomes?

Several scholars have suggested uncertainty about whether secure forest tenure rights arrangements will produce desirable outcomes (Fisher B. & Oviedo G. 2008; Chomitz *et al.* 2007). Secure tenure may lead to increased forest resource degradation and deforestation if such land use decisions offer higher economic returns. As Alston *et al.* (2000) point out, competition for property rights often involves clearing forest in the contested land area as a way to demonstrate active control and 'productive' use of the area. It is harder to prove stewardship to external agents based on landholder activities that avoid deforestation.

Other scholars have shown that secure community rights may further marginalize the poorer members of forest communities. In Vietnam, Quang Tan *et al.* (2008) find that there is little evidence that legal tenure has contributed to poverty alleviation. Indeed, in some cases it seems that the reforms have led to increased impoverishment of the poor as the wealthier or better-connected villagers tend to capture the benefits for themselves. In Tanzania, Shepherd (2008: 3) sees similar outcomes in the case of the ngitili forests of Shinyanga: Tenure rights are 'crystal-clear and of long standing', yet the poorer members of the communities are often excluded from decision making. 'Village leaders are not acting as umpires as they should, and the poor have no other advocate, so rights give way to power.'

These observations call for research that looks into the factors that influence the relationship between tenure security and outcomes in terms of both rural livelihoods and resource conditions.

4.6 What methodologies will effectively advance the field of forest tenure and property rights?

Ostrom (2003) argues that achievement of successful self-governance of forests and other common pool resources requires users to overcome

a series of collective action problems that do not always have apparent solutions. She argues that the individual incentives for users to self-organize often depend jointly on the attributes of the resource and the allocation functions (property rights and characteristics of the users). This means that to analyse these types of complex collective action problems, it is necessary to consider how different configurations of factors operate together and interact with each other. Not all analytical methods are useful for discerning such configurative relationships. In other words, the achievement of tenure security is likely to be a complex and dynamic process, which requires researchers to adapt their analytical approaches to the empirical reality, or else they will not be able to understand this reality.

Similarly, Mwangi and Markelova (2009: 23) call for a multi-methods approach to uncover causal relationships between institutions and poverty: 'While methodological pluralism is strongly advocated... it presents its own challenges for research design, as different research traditions are often reluctant to work together, for example because of potential tensions among their underlying assumptions.... innovative research designs are needed.'

CIFOR research should support a wide variety of approaches to analysing all the questions identified in this section. Methodological diversity is essential for achieving a deeper understanding of the causes and consequences of forest tenure and rights.

4.7 Meeting the demands of a changing policy world

In addition to responding to these identified knowledge gaps, the policy world presents its own challenges to researchers. Judging from the Food and Agriculture Organization's most recent *State of the World's Forest* report (FAO 2009) and the World Bank's *Forestry Strategy* (World Bank 2002), several new policy priorities have emerged, each with a number of policy options, in response to identified real-world opportunities and problems, and these call for deeper analysis. They include economic compensation of the production environmental services (including carbon sequestration, biodiversity conservation, soil protection and watershed protection), the role of the state in community-

based natural resource management, and the broad question of how research can interact more systematically with policy processes. The more CIFOR's research addresses these issues—as identified by both researchers and international policy actors—the more relevant it will be.

5. Criteria for review of CIFOR's work

A total of 53 CIFOR publications on forest tenure and property rights, selected by the CIFOR librarian, were reviewed. They represent all CIFOR publications that address forest tenure and property rights in some form and have been published since 2000. Appendix A presents the full list of publications. Each publication was evaluated based on five criteria, derived from CIFOR's strategic plan for 2008–2018, as described below.

1. **Addressing existing knowledge gaps:** Each study was assessed in terms of the degree to which it responds to the main gaps in knowledge of forest tenure and property rights, as discussed in the previous section.
2. **Contributing to cumulative knowledge by using or building shared data sets:** The review considered whether the study uses original data sets that have been made available to the wider research community so that results may be validated and replicated.
3. **Research design, methods, and data that allow for causal inference:** Does the study explain how empirical observations are selected and used for inference? Studies that are explicit in their descriptions of how cases are selected are less likely to overstate the generalizability of their results.
4. **Policy relevance and timeliness:** Policy relevance was assessed on the basis of whether the study identifies a connection to specific policy information needs.
5. **Impact on research:** The study's influence on the broader field of research was assessed on the basis of how many other studies have cited it, as measured by the number of citations listed in Google Scholar.

6. Results

For each of the five criteria outlined in the previous section, the reviewer created an indicator that could be identified and measured. The reviewer analysed the content of the studies and assessed the extent to which they met the criteria by estimating the strength of the corresponding indicator. Appendix B presents the details of the indicator measurement process.

6.1 Addressing existing knowledge gaps

The reviewer made a subjective assessment of the extent to which each of the selected CIFOR publications addresses the knowledge gaps outlined above. If the reviewer saw evidence of one of the six highlighted gap areas being addressed in a given publication, a value of 1 was assigned, otherwise 0. Cases in which the knowledge gaps were mentioned but were not the main analytical subject were assigned a value of 0.5. As illustrated in Figure 3, 34 per cent of the selected publications address at least one of these gap areas head on, 26 per cent address them in a limited way, while the remaining 40 per cent do not touch on any of the identified areas.

6.2 Contributing to cumulative knowledge by using or building shared data sets

The reviewer searched the methods and data sections of all the publications to find out whether the original data used for the analysis was publicly

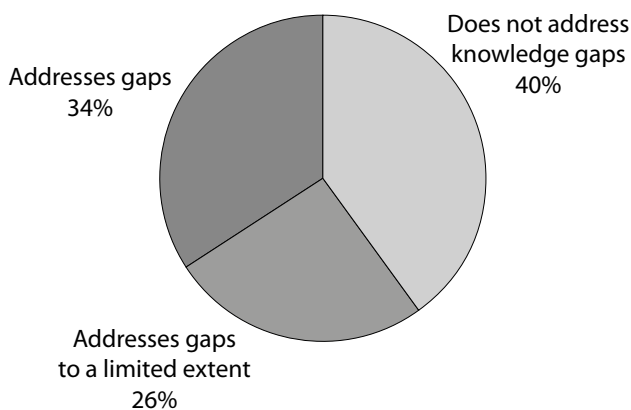


Figure 3. Do CIFOR publications address the identified knowledge gaps?

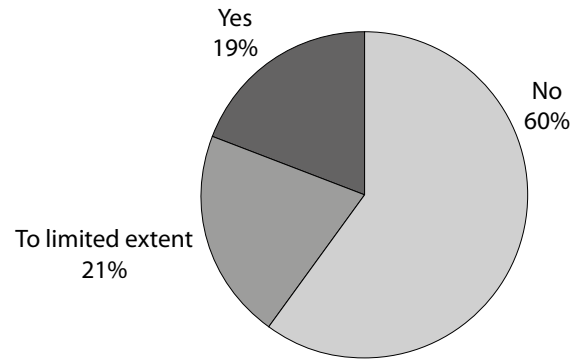


Figure 4. Do CIFOR studies use or build shared data sets?

available. If this was the case, a value of 1 was assigned. If the data was not publicly available but is accessible to multiple researchers within a network, such as the ACM, a value of 0.5 was assigned. If no data were used, or if the data did not appear to be shared with other researchers, thereby making cumulative empirical analysis impossible, a value of zero was assigned (Figure 4).

This may be the area in which an effort by CIFOR could make the biggest difference for new knowledge development, both within and outside the organization. Fewer than half of the studies contributed to building better data sets accessible to the research community at large.

6.3 Research design, methods, and data that allow for causal inference

The reviewer studied the methodological approach taken by each of the 53 studies and assessed the extent to which the authors used data to test a causal argument. The reviewer looked for two necessary ingredients of causal inference: a discussion of case selection (what selected cases represent in terms of the paper’s argument) and empirical tests of the argument using data, regardless of analytical methods chosen. If the paper did specify what the cases analysed represented in terms of the arguments or hypotheses to be tested and used data to test the argument, a value of 1 was assigned, otherwise 0 (Figure 5).

The subjective assessment shows that in the vast majority of CIFOR-sponsored research, the possibility of causal inference is weak or absent. One

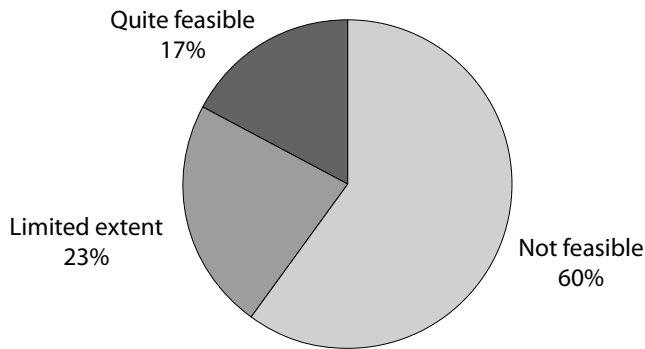


Figure 5. To what extent is causal inference feasible in CIFOR research?

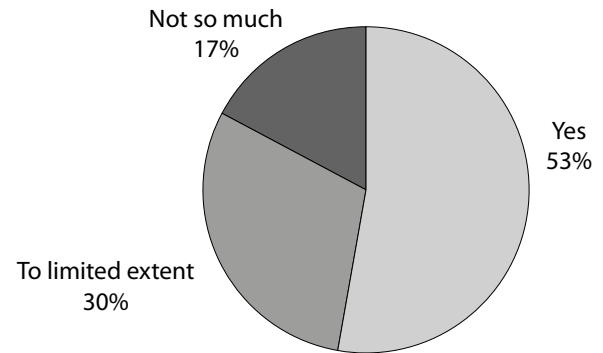


Figure 6. Does CIFOR research address urgent policy needs?

of the most likely explanations for this observation is that many CIFOR publications do not specify how cases were selected or what they represent. In some cases, selection criteria are discussed but are not linked to the causal argument of the paper, limiting causal inference. The majority of CIFOR publications rely on qualitative methods. But causal inference is no less feasible for qualitative methods than for quantitative methods. Qualitative research methods are not inferior to quantitative approaches per se, but using such methods does require the researcher to think carefully about the reasons for including or excluding particular cases in the analysis.

6.4 Policy relevance

The relevance of a study for members of the policy community was assessed by determining whether it identifies and responds to a specific policy need. Studies that explicitly identified policy needs for specific policy actors were given a score of 1; studies that did not explicitly identify such needs but analysed issues of high policy value as determined by the international forest policy agenda (as expressed by (2009) and World Bank (2002) publications mentioned in the previous section) were given a score of 0.5, and studies that did neither were given a score of 0. The results of this analysis are presented in Figure 6. This is an area in which CIFOR research excels. Few research organizations can boast that 83 per cent of their studies address urgent policy needs to some degree.

6.5 Impact on research

To estimate the impact of CIFOR's work on the research community, the reviewer used Google Scholar to ascertain the number of publications

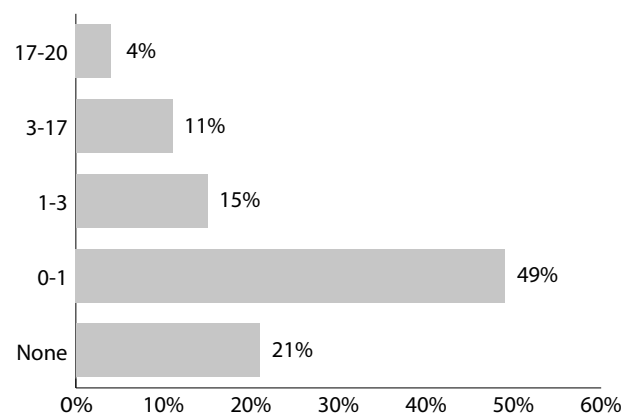


Figure 7. Citations of CIFOR forestry studies per year

that had cited the CIFOR publications. An average number of citations per year was calculated for each publication. Figure 7 presents the results of this analysis.

On average, CIFOR publications in this area of research are cited 1.9 times per year by other scholars. To put this number into perspective, the reviewer performed a different search on Google Scholar to calculate the average number of citations for the 10 most cited works for the keywords 'forest,' 'property rights' and 'tenure'. The average was 23.1 citations per year.

The CIFOR publications that are most cited by other scholars are also the ones that score high in several other categories (such as policy relevance and addressing research gaps), suggesting that there are no apparent trade-offs between policy relevance and academic publication for CIFOR researchers in terms of selecting research topics.

This result also suggests that the number of citations per year may work as a relatively good proxy performance indicator for CIFOR researchers, as this number reflects, to a certain extent, how well the CIFOR strategic goals are being addressed by the research. To test this claim, the reviewer performed a correlation analysis of the citations per year and the cumulative score of the other four performance indicators for the 53 publications. The Pearson r score was found to be 0.7, indicating a high correlation between citations per year and performance on the other four criteria reviewed here.

7. Discussion

The five criteria and associated indicators reflect the goals of the CIFOR Strategy 2008–2018. First, the review identified six research questions that the existing literature on forest tenure and property rights has yet to address in any empirical depth. All of these questions are directly linked to CIFOR's aspiration to develop a better understanding of 'the relationships among forests, poverty and the environment, and how management and governance arrangements affect livelihood and conservation outcomes' (CIFOR 2008: 10). Such an understanding requires more and deeper **analysis of the identified knowledge gaps**.

Since CIFOR's own publications, which were reviewed here, form part of this broader literature, which has addressed these questions only tangentially, the finding that merely 34 per cent of CIFOR's publications deal with issues directly related to one of these six topics noteworthy. It is encouraging to see that the proportion is much higher among the more recent publications, suggesting that the research agenda at CIFOR is adapting to the emerging needs for knowledge in these areas.

The second criterion used in the review, **contribution to cumulative knowledge by using or building shared data sets**, is linked to CIFOR's goal to 'establish a data repository for its research data and ensure it is enriched with metadata for easy access. The Center will also provide the staff resources, policies, and procedures necessary for ensuring that data is captured, managed and made available to the research community as appropriate' (CIFOR 2008: 14). CIFOR has some distance

to go before it achieves these goals in the area of forest tenure and rights. Fewer than 20 per cent of all CIFOR publications use or build data sets that appear to be available to the broader research community.

CIFOR has a strong commitment to conduct and support research that is 'based on solid science' and is capable of deriving 'general patterns and causal mechanisms of global importance' (CIFOR 2008: 14). To assess this aspect of the organization's work, the reviewer examined the extent to which the studies in question sought to test claims empirically and whether they addressed research design, methods choice, or empirical tests of causal mechanisms. Less than a fifth of CIFOR's studies in this area were found to take **research design and causal inference** seriously enough to discuss them explicitly. This suggests that the CIFOR leadership needs to engage its researchers in a discussion about why this may be the case. If unaddressed, this shortcoming may have serious consequences for CIFOR's credibility as a research organization with a commitment to solid science.

One of CIFOR's strengths is the **policy relevance** of its research, the fourth criterion examined in the review. As stated in the CIFOR Strategy, 'Relevance underpins an organisation's reason for being—the organization must be focused on issues regarded as crucial by its key stakeholders (without being excessively donor-driven), and be able to provide the necessary results and advice at the right time in the right format' (CIFOR 2008: 13). The findings of the review confirm that CIFOR is taking this goal seriously—more than 80 per cent of the studies addressed the needs of specific and identified policy actors, at least to some degree.

One of CIFOR's own performance indicators is the publication record of its scientists. The CIFOR Strategy stresses that 'CIFOR will be more systematic in assessing scientific publication outlets for their impact potential and ability to reach target audiences and pay more attention to assessing publication performance' (CIFOR 2008: 14). Apart from merely counting the number of articles and books that researchers publish in high-impact, peer-reviewed outlets, it may be worthwhile for CIFOR to assess the **impact of its research** by considering the number of citations that CIFOR publications receive from other researchers. The results of such an analysis

revealed extremely mixed levels of impact. The central tendency in the data is not positive in that about 70 per cent of all CIFOR studies in this area are cited one time per year or less. This means that most of CIFOR's research does not have a strong influence on the research agendas of other researchers, which is a problem for an organization that seeks to have an impact on research agenda-setting.

The small number of citations may seem of little consequence, especially since researchers do not constitute CIFOR's most important target or beneficiary group. After all, CIFOR research is supposed to inform the individuals who are most directly involved with 'policies and practices that affect forests in developing countries (CIFOR 2008: 3), and researchers are arguably not members of that group. However, the citations-per-year indicator is closely correlated ($r = 0.7$) with the sum of the first four indicators used in this review. This result would indeed suggest that measuring the number of citations received is a valid performance indicator. In fact, it may be worthwhile for the organization to consider using this indicator as the basis for an incentive scheme that rewards good research performance.

8. Conclusion

CIFOR's strategy for 2008–2018 highlights the organization's commitment to carry out research that addresses the relationships between forests, poverty and the environment, and specifically how management and governance arrangements affect livelihood and conservation outcomes. To understand such relationships requires explicit recognition of the role played by tenure and property rights in the governance process, because, as discussed in the section on conceptual definitions in this report, tenure and property rights form an integral part of the governance process and have direct implications for human decisions about forest use.

CIFOR has achieved considerable success in establishing itself as a leader in research on forest tenure and property rights. Since 2000, 53 publications on the topic have been released—some of which are among the most cited works in this strand of the literature. Based on this review

of those publications in light of the organization's strategic goals and aspirations, four main lessons stand out:

1. **CIFOR's work on forest tenure and property rights would benefit from conceptual development and diversification.** The conceptual orientation of the work to date has been rather narrow, focusing to a large extent on *de jure* rights and the need for governments to recognize rural people's rights to access and use forest resources. While such rights represent a critical first step towards achieving increased tenure security, there are many other contextual factors that affect such security in both direct and indirect ways. Unpacking the concepts of forest tenure and property rights, along the lines of the section on conceptual definitions and clarifications in this report, would help CIFOR to identify existing knowledge gaps and new potential questions for research.
2. **One way of strengthening CIFOR's research would be to diversify its methodological orientation.** Most of the published work is dominated by an in-depth, qualitative, place-based case study approach. While such an orientation is not inherently inferior to any other approach, it is just one approach. The adequacy of the methodological approach depends on the question asked, the data available, time, and resources. Hence, it would be warranted for the organization to encourage its researchers to move beyond the case-study approach to explore the use of complementary methodologies.
3. **At least six areas of research are currently underexplored by most researchers concerned with forest governance.** These are (a) the politics of forest tenure reform, (b) when tenure reform increases tenure security, (c) what factors contribute to establishing more secure forest tenure, (d) what the role of government is in increasing forest tenure security, (e) under what conditions forest tenure leads to sustainability and (f) what methods provide the best analytical leverage for these areas of research. The majority of CIFOR's 53 publications did not address any of these six questions. By addressing some of these questions in its future research, CIFOR would help inform decision making in areas that currently do not receive much guidance from science.

4. **The empirical analysis of CIFOR's research on forest tenure shows mixed performance outcomes.** While the organization excels in its commitment to conducting policy-relevant research, its performance on the other four indicators derived from the CIFOR Strategy for 2008–2018 was not as strong. As CIFOR seeks to meet its goals, as expressed in the Strategy, CIFOR staff might use the identified performance indicators to monitor progress and as a basis for organizational learning about how to become more effective in achieving those goals.

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Appendix A. CIFOR studies on forest tenure and rights

#	Title	Author and year
1	Beyond timber: certification of non-timber forest products. EFRN News (39–40): 65–67. European tropical forest Research Network..	Shanley, P. 2003
2	Community-based fire management, land tenure and conflict: insights from Sumatra, Indonesia. p.27-32. <i>In</i> : Moore, P., Ganz, D., Tan, L.C., Enters, T. and Durst, P.B. (eds.) Communities in flames. No. RAP Publication 2002/25. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand.	Suyanto, S., Applegate, G. and Tacconi, L. 2002
3	Comparison of bamboo production systems in six counties in China. <i>In</i> : Fu Maoyi, Ruiz Perez, M. and Yang Xiaosheng (eds.) Proceedings of a workshop on China social economics.	Ruiz Perez, M. and Belcher, B. 2001
4	Conflict in resource management for ecosystem services: water in Lashi watershed, Lijiang. Economic and Political Weekly 36(30): 2851–58.	Yu Xiaogang 2001
5	Conservation and sustainable use of wildlife-based resources through the framework of the Convention on Biological Diversity (CBD): the bushmeat crisis. Nature and Fauna 23(1): 32–39.	Christophersen, T. and Nasi, R. 2008
6	Deforestation and forest degradation in lowland Bolivia. <i>In</i> : Wood, C.H. and Porro, R. (eds.) Deforestation and land use in the Amazon, 66–94. University of Florida Press, Gainesville, USA.	Pacheco, P. 2002
7	Forestry research, innovation and impact in developing countries—from economic efficiency to the broader public good. Forestry Chronicle 78(1): 103–107.	Spilisbury, M.J. and Kaimowitz, D. 2002
8	Ilala palm (<i>Hyphaene petersiana</i>) use in southern Zimbabwe: social and ecological factors influencing sustainability. Forests, Trees and Livelihoods 13: 275–96. ISSN: 1472-8028.	Foote, A.L. <i>et al.</i> 2003
9	Learning lessons from China's forest rehabilitation efforts: national level review and special focus on Guangdong Province. Review of forest rehabilitation: lessons from the past. CIFOR, Bogor, Indonesia. ISBN: 979-24-4667-2.	Chokkalingam, U., Zhou Zaichi, Wang Chunfeng and Toma, T. (eds.) 2006
10	Macroeconomic policies and industrial wood processing and trade in Zimbabwe. Forest Policy and Economics 8(1): 22–34. ISSN: 1389-9341.	Kowero, G.S. and Mabugu, R. 2005
11	Managing natural forests for sustainable harvests of mahogany (<i>Swietenia macrophylla</i>): experiences in Mexico's community forests. Unasylva 54(214–215): 68–73.	Snook, L.K. <i>et al.</i> 2003
12	Modeling deforestation at distinct geographic scales and time periods in Santa Cruz, Bolivia. International Regional Science Review 27(3): 271–96.	Mertens, B. <i>et al.</i> 2004
13	Proceedings of the Workshop on China Social Economics, Marketing and Policy of the Bamboo Sector, 16–18 June 1999, Beijing. China Forestry Publishing House, Beijing. 235p. ISBN: 7-5038-2704-1.	Fu Maoyi, Ruiz Perez, M. and Yang Xiaosheng (eds.) 2001
14	Pro-poor payments for environmental services: challenges for the government and administrative agencies in Vietnam. Public Administration and Development 28(5): 363–73.	Pham, T.T., Hoang, M.H. and Campbell, B.M. 2009
15	Pulp industry and plantation development in Indonesia: experiences and potential lessons for China. <i>In</i> : Guangcui, D., White, A. and Barr, C. (eds.) Proceedings of the International Forum on Investment and Finance in China's Forestry Sector: China and forest trade in the Asia-Pacific Region: implications for forest and livelihoods, 95–107. China Land Publishing House, Beijing, China.	Cossalter, C. 2006
16	The community forestry program in Cameroon: a participatory management option? Working Paper No. 5. 47p. CIFOR, Cameroon.	Nforti, N.C. 2000
17	The compatibility of timber and non-timber forest product extraction and management. Forest Ecology and Management 256: 1477–81. doi: 10.1016/j.foreco.2008.03.038. ISSN: 0378-1127.	Guariguata, M.R., Cronkleton, P., Shanley, P. and Taylor, P.L. 2008

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Appendix A. Continued

#	Title	Author and year
18	The secondary forest situation in Sri Lanka: a review. <i>Journal of Tropical Forest Science</i> 13(4): 768–85.	Perera, G.A.D. 2001
19	The utilization and management of African rattans: constraints to sustainable supply through cultivation. <i>Forests, Trees and Livelihoods</i> 18: 337–53. ISSN: 8028-2008.	Sunderland, T.C.H., Balinga, M., Asaha, S. and Malleson, R. 2008
20	Trends and future scenarios of forestry and other land uses employment in Indonesia: a modeling approach. <i>Economics and Finance in Indonesia</i> 54(1): 1–24.	Purnomo, H. 2006
21	Trends and impact of forest tenure reforms in Asia: cases from India, Indonesia, Lao PDR, Nepal and the Philippines. <i>Journal of Forest and Livelihood</i> 7(1): 19–26. ISSN: 1684-0186.	Dahal, G.R. and Adhikari, K.P. 2009
22	A weighted decision and tenurial niche approach to analyzing adaptive learning in the social forests of northeastern Zimbabwe. <i>In: Mandondo, A., Matose, F. and Prabhu, R. Coping amidst chaos: studies on adaptive collaborative management from Zimbabwe</i> , 91–119. CIFOR, Bogor, Indonesia. ISBN: 978-979-14-1264-3.	Chahweta, C. and Mandondo, A. 2008
23	Agrarian reform in the Brazilian Amazon: its implications for land distribution and deforestation. <i>World Development</i> 37(8): 1337–47.	Pacheco, P. 2009
24	Community forest enterprise markets in Mexico and Brazil: new opportunities and challenges for legal access to the forest. <i>Journal of Sustainable Forestry</i> 27(1–2): 87–121.	Molnar, A. <i>et al.</i> 2008
25	Community forestry in Yunnan (China): the challenge for networks. CIFOR, Bogor, Indonesia. 34p.	Colchester, M. 2002
26	Contrasted land use and development trajectories in the Brazilian Amazon. <i>Bois et Forêts des Tropiques</i> 280: 17–27. ISSN: 0006-579X.	Mertens, B. <i>et al.</i> 2004
27	Damar agroforests in Sumatra, Indonesia: domestication of a forest ecosystem through domestication of dipterocarps for resin production. <i>In: Kuster, K. and Belcher, B. (eds.) Forest products, livelihoods and conservation: case studies of non-timber forest product systems, Volume 1: Asia</i> , 207–226. CIFOR, Bogor, Indonesia.	De Foresta, H., Michon, G., Kusworo, A. and Levang, P. 2004
28	Decentralization of forest administration in Indonesia: implications for forest sustainability, economic development and community livelihoods. CIFOR, Bogor, Indonesia. 178p. ISBN: 979-24-4649-4.	Barr, C. <i>et al.</i> 2006
29	Forest certification in Indonesia. pp. 25–32, 33–68. <i>In: Cashore, B., Gale, F., Meidinger, E. and Newsom, D. (eds.) Confronting sustainability: forest certification in developing and transitioning countries Yale F&ES Report No. 8.</i> Yale Publishing Services Center, New Haven.. ISBN: 0-9707882-5-8.	Muhtaman, D.R. and Prasetyo, F.A. 2004
30	Forest-related conflict: impacts, links and measures to mitigate. Rights and Resources Initiative, Washington, DC. 52p.	de Koning, R.G., Capistrano, D., Yasmi, Y. and Cerutti, P.O. 2008
31	How can market mechanisms for forest environmental services help the poor?: preliminary lessons from Latin America. <i>World Development</i> 33(9): 1511–27. ISSN: 0305-750X.	Grieg-Gran, M., Porras, I. and Wunder, S. 2005
32	Recent experience in collaborative forest management: a review paper. CIFOR Occasional Paper No. 43. CIFOR, Bogor, Indonesia. 48p.	Carter, J. and Gronow, J. 2005
33	Spatial regression analysis of deforestation in Santa Cruz, Bolivia. <i>In: Wood, C.H. and Porro, R. (eds.) Land use and deforestation in the Amazon</i> , 41–65. University Press of Florida, Gainesville, USA.	Kaimowitz, D., Mendez, P., Puntodewo, A. and Vanclay, J.K. 2002
34	Tenure and adat in Malinau. <i>In: Moeliono, M., Wollenberg, E. and Limberg, G. (eds.) The decentralization of forest governance: politics, economics, and the fight for control of forest in Indonesian Borneo</i> , 222–240. ISBN: 978-1-84407-586-7.	Moeliono, M. and Limberg, G. 2008

Appendix A. Continued

#	Title	Author and year
35	Tenure reform on Philippine forest lands: assessment of socio-economic and environmental impacts. Philippines College of Forestry and Natural Resources. 111p. ISBN: 978-971-579-057-4.	Pulhin, J.M., Dizon, J.T., Cruz, R.V.O., Gevana, D.T. and Dahal, G.R. 2002
36	Action research with local forest users and managers: global lessons from CIFOR's research on adaptive collaborative management. <i>In</i> : Scoones, I. and Thompson, J. (eds.) <i>Farmer first revisited: innovation for agricultural research and development</i> , 66–70. Practical Action.	Prabhu, R., Colfer C.J.P., Diaw, C., McDougall, C. and Fisher, R. 2008
37	Amazon deforestation revisited. <i>Latin American Research Review</i> 37(2): 221–35.	Kaimowitz, D. 2002
38	Commercialisation of non-timber forest products: review and analysis of research. CIFOR, Bogor, Indonesia. 176p.	Neumann, R.P. and Hirsch, E. 2000
39	Conclusions and policy implications. <i>In</i> : Hyde, W.F., Jintao Xu and Belcher, B. (eds.) <i>China's forests: global lessons from market reforms</i> , 195–214. Resources for the Future and CIFOR, Washington, DC.	Hyde, W.F., Jintao Xu, Belcher, B., Runsheng Yin and Jinlong Liu 2003
40	Evolution of land policies and legislation in Malawi and Zimbabwe: implications for forestry development. <i>Zimbabwe Science News</i> 36.	Mataya, C., Gondo, P. and Kowero, G.S. 2003
41	Forest certification: a policy perspective. CIFOR, Bogor, Indonesia. 310p.	Elliott, C. 2000
42	Indigenous communities' knowledge of local ecological services. <i>Economic and Political Weekly</i> 36(30): 2859–69.	Kumar, S. 2001
43	Maximum yield?: sustainable agriculture as a tool for conservation. Biodiversity Support Program, Washington, DC. 62p.	Margoluis, R. <i>et al.</i> 2001
44	Modern economic theory and the challenge of embedded tenure institutions: African attempts to reform local forest policies. <i>Sustainability, Economics, and Natural Resources</i> No. v. 2. <i>In</i> : Kant, S. and Berry, R.A. (eds.) <i>Sustainability, institutions and natural resources: institutions for sustainable forest management</i> , 43–81. Springer, Amsterdam, Netherlands. ISBN: 1-4020-3479-2.	Diaw, C. 2005
45	Regulating industrial forest concessions in Central Africa and South America. <i>Forest Ecology and Management</i> 256: 1498–1508. doi: 10.1016/j.foreco.2008.07.001. ISSN: 0378-1127.	Karsenty, A., Drigo, I.G., Piketty, M.G. and Singer, B. 2008
46	Tenure and management of non-state forests in China since 1950: a historical review. <i>Environmental History</i> 6(2): 239–63.	Liu Dachang 2001
47	Tenure rights and beyond: Community access to forest resources in Latin America. Occasional Paper No. 50. CIFOR, Bogor, Indonesia. 92p. ISBN: 978-979-1412-43-8.	Larson, A.M., Cronkleton, P., Barry, D. and Pacheco, P. 2008
48	The promises and limitations of devolution and local forest management in China. <i>In</i> : Edmunds, D. and Wollenberg, E. (eds.) <i>Local forest management: the impacts of devolution policies</i> , 20–54. Earthscan, London.	Liu Dachang and Edmunds, D. 2000
49	The restoration of forest biodiversity and ecological values. <i>Forest Ecology and Management</i> 201(1): 3–11. ISSN: 0378-1127.	Sayer, J.A. <i>et al.</i> 2004
50	The role of fire in changing land use and livelihoods in Riau-Sumatra. <i>Ecology and Society</i> 9(1): 15p.	Suyanto, S. <i>et al.</i> 2004
51	The role of informal institutions in the use of forest resources in Latin America. <i>Forests and Governance Programme Series</i> No. 15. CIFOR, Bogor, Indonesia. 78p.	Pacheco, P., Barry, D., Cronkleton, P. and Larson, A.M. 2008
52	Towards solutions for state vs. local community conflicts over forestland: the impact of formal recognition of user rights in Krui, Sumatra, Indonesia. <i>Human Ecology</i> 35(4): 427–38.	Kusters, K., De Foresta, H., Ekadinata, A. and van Noordwijk, M. 2007
53	Unlocking complexity: the importance of idealisation in simulation modelling. Special issue, <i>Small-Scale Forest Economics, Management and Policy</i> 2(2): 293–312.	Haggith, M. and Prabhu, R. 2003

Appendix B. CIFOR studies performance indicators

Study #	Knowledge gaps	Shared data	Causal tests	Policy relevance	Citations per year
1	0	0	0	1	1.000
2	0	0	0	0.5	0.125
3	0	0	1	0	0.111
4	0	0	0	1	0.000
5	0	0	0	1	0.000
6	0	0	0	1	0.750
7	0	0	0	1	0.625
8	0	0	1	0	0.000
9	0	0	0	1	0.750
10	0	0	0.5	0.5	0.000
11	0	0.5	1	0.5	0.429
12	0	1	1	0.5	2.833
13	0	0	0	0	0.000
14	0	0	0	1	0.500
15	0	0	0	0	0.000
16	0	0	0	1	0.000
17	0	0.5	0.5	0.5	1.000
18	0	0	0	0	0.667
19	0	0	0	0	0.000
20	0	0	0.5	0.5	0.250
21	0	0	0.5	1	0.000
22	0.5	0.5	0	0	0.500
23	0.5	0.5	1	1	3.000
24	0.5	0	0	1	0.000
25	0.5	0	0	1	0.625
26	0.5	1	1	0.5	0.333
27	0.5	0	0	1	0.333
28	0.5	1	0	1	4.250
29	0.5	0	0	1	0.667
30	0.5	0	0	1	0.500
31	0.5	1	1	1	20.600
32	0.5	1	0	1	3.200
33	0.5	1	1	0.5	1.500
34	0.5	0	0	0.5	0.000
35	0.5	0.5	0	0.5	0.250
36	1	0.5	0	0.5	1.000
37	1	1	0	1	2.500
38	1	0.5	1	1	17.000
39	1	0	0.5	1	2.714
40	1	0	0	0.5	0.571
41	1	1	1	1	7.600
42	1	0	0.5	0.5	0.667
43	1	0	0	1	1.000
44	1	0	0	0.5	1.200
45	1	0	0.5	0	1.000
46	1	1	0	1	4.778
47	1	0.5	0	0.5	2.500
48	1	0	0	1	0.800
49	1	1	1	1	6.667
50	1	0.5	1	1	1.667
51	1	0.5	0	0.5	0.500
52	1	0	0.5	1	4.000
53	1	0.5	0	0	1.000

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