

# Overview

# At Loggerheads?

**Agricultural Expansion,  
Poverty Reduction,  
and Environment  
in the Tropical Forests**

**Kenneth M. Chomitz**

with

Piet Buys, Giacomo De Luca,  
Timothy S. Thomas, and  
Sheila Wertz-Kanounnikoff

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1818 H Street NW  
Washington DC 20433  
Telephone: 202-473-1000  
Internet: [www.worldbank.org](http://www.worldbank.org)  
E-mail: [feedback@worldbank.org](mailto:feedback@worldbank.org)

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# Contents

Why Are Tropical Forests a Concern?	1
This Report's Aims, Audience, and Scope	4
This Report's Arguments and Structure	6
This Report's Recommendations	25
Conclusions	27
References	28

## **Boxes, Figures, Maps, and Tables**

Box 1	This Report's Geographic Scope	2
Box 2	Unreliable Generalizations about Deforestation and Poverty	5
Box 3	The World Bank's Forest Strategy	7
Box 4	Poverty and Forests in Two Indonesian Islands	16
Figure 1	Structure of This Report's Arguments	8
Figure 2	Deforestation in Brazilian Amazônia Is Shaped by Rainfall and Farmgate Prices of Beef, 2001–03	14
Figure 3	Remoteness, Poverty, and Forest Cover in Nicaragua	17
Figure 4	Deforestation Would Be Unprofitable in Many Land Systems at Modest Carbon Prices	24
Map 1	This Report's Focus: Tropical Forests and Savanna Woodlands	2
Map 2	Domains in Africa's Tropical Forest Biomes	10
Map 3	Domains in Asia's Tropical Forest Biomes	11
Map 4	Domains in Latin American and Caribbean Tropical Forest Biomes	12
Table 1	Forest Types and Their Challenges	
Table 2	Stylized Forest Types Have Equivalents in Mapped Domains	10
Table 3	Forest Populations and Areas Vary by Continent, Biome, Domain, and Remoteness, 2000	13
Table 4	Alternative Bundles of Forest Rights	21

**Deforestation is undertaken by rich and poor, for gains small and large**



Deforestation in Madagascar's moist forests is undertaken for low-yielding upland rice cultivation.

© Rickey Rogers / Reuters / Corbis.



Recently cleared farmland abuts Amazonian forest in Mato Grosso state, Brazil.

© Louise Cobb / Corbis SABA.

# Overview

Over the past three decades tropical forests have captured the world's attention. There have been endless meetings, stacks of reports, demonstrations in the streets, and billions of dollars poured into forest projects.

## Why Are Tropical Forests a Concern?

Two broad concerns have driven this attention.

### Tropical Forests Are Shriveling before Our Eyes

Satellites allow us to watch forests burn in real time. The tropical forest estate, extraordinarily large at the middle of the 20th century, is shrinking at about 5 percent a decade. By the middle of the 21st century only shreds of this once-vast forest may be left. Unless trends change, the consequences will be severe: 3 billion tons of carbon dioxide (CO<sub>2</sub>) added to the atmosphere each year, intensifying climate change; loss not just of many species but also entire ecosystems; and across the tropics, widespread changes in water flows, scenery, microclimates, pests, and pollinators. These environmental damages would touch people near and far.

Pressures on forests will not disappear soon. Croplands, pastures, and plantations are expanding into natural forests and will likely do so for the next 30–50 years. Expansion is driven by both wealth and poverty. A huge rural population relies on low-productivity agriculture for subsistence. A growing, increasingly wealthy urban population demands commodities produced at the forest's edge: beef, palm oil, coffee, soybeans, and chocolate.

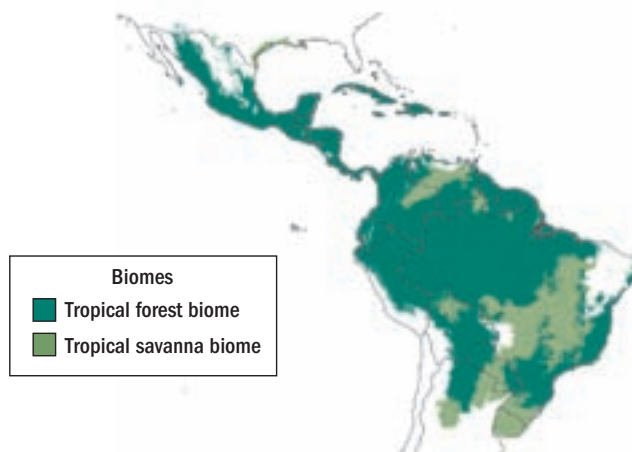
### Box 1 This Report's Geographic Scope

To keep this report's scope manageable, it focuses on the developing world's tropical forests and savanna woodlands, with an emphasis on the former. This approach was chosen somewhat reluctantly, since there are important challenges related to the management of boreal and temperate forests, and some forest governance issues cut across all forest types. But tropical forests face distinct issues and challenges. They are home to most of the world's poor forest dwellers and contain the bulk of its forest-based biodiversity, and it is

here where almost all deforestation and forest-related carbon emissions occur.

This report looks broadly at ecosystems, rather than narrowly at trees. The focus is on tropical and subtropical forest and savanna biomes—that is, areas originally covered by these types of vegetation (map 1). Excluded from these areas but sometimes included in the discussion are xeric shrublands (such as in southwest Madagascar or the Brazilian *caatinga*) and montane grasslands and shrublands (as in the highest elevations of the Andes).

**Map 1 This Report's Focus: Tropical Forests and Savanna Woodlands**



Source: Authors' mapping of data from WWF 2001.

The Food and Agriculture Organization (of the UN) predicts that the growth in such demand will slow—but still expects croplands in the developing world to expand by a net 3.8 million hectares a year over the next three decades (Bruinsma 2003). Gross expansion will be even greater, because some farmland is abandoned. And these estimates do not include expansion of pastures and planted forests.

**Box 1 (continued)**

The report devotes relatively little attention to plantation management.

The report often uses data and examples from Brazil, for several reasons. Brazil contains a large portion of the world's tropical forests, including disparate types: remote, dense rainforests; savannas; and highly fragmented, long-settled forests of extreme biodiversity. It also has a diverse array of forest actors: indigenous people, subsistence-oriented smallholders, extractivists, agrobusinesses. Due to concerns in civil society and government,

Brazil has extensive experience grappling with land and forest use regulation—experience from which other countries can learn. Finally, Brazil has superb statistics on its population, economic conditions, and deforestation. Indeed, it is partly because of the Brazilian government's bold decision to regularly monitor and publicize deforestation rates that the world pays more attention to deforestation in Brazilian Amazônia than in other, less transparent regions.



Forests are also under pressure from loggers. Poor people need fuelwood, and a wealthier world demands more wood and pulp—demands only partly met by plantations. Logging thins and degrades forests and helps finance and provide access to farmers and entrepreneurs who burn unsellable trees to establish agriculture.

## Forests Are Home to Some of the World's Poorest People

Forests play a crucial role in the lives of many poor people. Almost 70 million people—many indigenous—live in remote areas of closed tropical forests. Another 735 million rural people live in or near tropical forests and savannas, relying on them for much of their fuel, food, and income—or chopping them down for crops and pasture. From a policy viewpoint, what is distinctive about forest poverty relative to other rural poverty? How is it related to deforestation? When are forests a geographic poverty trap—and when are they a route out of poverty?

## This Report's Aims, Audience, and Scope

Despite the volume of published material, confusion remains about the causes of forest loss and forest poverty and about effective policy responses. Forest discourse often relies on unreliable generalizations (box 2). Although there is an element of truth in each of these generalizations, uncritical application of them can impede diagnosis of poverty and environmental problems—and without proper diagnoses, prescriptions can go awry. Two examples:

- Kerinci-Seblat National Park, in Sumatra, Indonesia, is one of the world's richest, most distinctive biodiversity sites, containing 4,000 plant species and 3 percent of Earth's mammal species—including threatened ones such as the clouded leopard and small Sumatran rhinoceros. A World Bank–Global Environment Facility project sought to deter deforestation by boosting local incomes. But deforestation in Kerinci was driven not by poverty, but by avarice and opportunity. The region's forests consist of prized hardwoods, and its cool climate and volcanic soils make it one of the best places in the world to grow cinnamon. Modest assistance to local people didn't deter them from deforestation and had no effect on outsiders who sought to cash in on the region's wealth (MacKinnon 2005).
- A Panamanian land-use plan envisioned reforestation 144,000 hectares of pasture to protect the Panama Canal watershed—a project that might cost more than \$250 million. But a study found that this investment

could have a result contrary to what was expected, reducing rather than increasing water available to the canal during the dry season. Over time, such a change would cost Panama \$630 million in revenues and raise global shipping costs by \$3 billion (Aylward 2002).

This report seeks to improve the diagnosis of forest problems and facilitate the prescription and application of solutions. It offers tools for tackling two issues related to environmental management and regional development policies:

- Some people benefit, and some people are harmed, when forest is degraded or converted to agriculture. How should society intermedate between these groups?
- How pervasive is poverty among forest dwellers? What approaches are needed to address it? And how do policies for reducing forest poverty relate to those for mitigating deforestation?

## Box 2 Unreliable Generalizations about Deforestation and Poverty

### **Poverty causes deforestation**

Poor people deforest, but so do the rich. Added income may not deter poor people from deforestation.

### **Deforestation causes poverty**

Depending on who does it and why, deforestation can destroy or create assets for poor people.

### **Highly forested areas tend to be very poor**

Many factors muddle this relationship. Remote areas tend to have high forest cover and high poverty rates, but they also usually have low absolute numbers of poor people. Forest dwellers can prosper when they can profitably access forest resources—or suffer when those resources are meager or controlled by others.

### **Deforestation causes floods and reduces dry season flows**

Deforestation's impacts vary considerably depending on the watershed's size and steepness and how the land is subsequently used. It often increases dry season flows, but in some cases could reduce them.

### **High timber prices promote forest conservation**

High timber prices motivate “mining” of unprotected old-growth forests—but can also increase returns to regulated logging and stimulate management of secondary forests and plantations in areas already logged over.

The report is directed at people concerned about environmental and poverty policies in the tropical world—particularly those who have to straddle sectors or disciplines. It can help designers of conservation projects assess the plausibility of assumptions about links between conservation and poverty. Local governments and stakeholders might use it to think about their goals and tools for regional development in forested areas. At the national level, it seeks to provide a platform for discussions among environment, agriculture, forest, and finance ministries. It can inform policy makers and voters in formulating equitable, enforceable regulations on land and forest use. Finally, it is intended to contribute to international discussions about the role of forest conservation in mitigating climate change.

The report's cross-sector approach can inform implementation of the World Bank's Forest Strategy (box 3). The strategy recognizes that forests are undervalued because their environmental services fall outside markets and emphasizes the need to reward forest managers for these services. It also recognizes that tapping forests' potential for poverty reduction and sustainable economic development requires politically complex trade-offs between the different groups interested in conservation and production and involves cross-sector coordination.

Though this report has broad ambitions, it is limited in scope. It focuses one spotlight on the causes and consequences of forest conversion to agriculture, and another, somewhat overlapping, spotlight on the nature and location of forest poverty. Those spotlights cover a lot of material, but leave many traditional forestry topics partially shadowed. Such issues—the economics of investing in plantations and building capacity among small sawmills and furniture enterprises; the policy rationales for stimulating smallholders to grow pulpwood; introducing marketing interventions for community forests; promoting reduced-impact logging; and controlling illegal logging—enter the story, mainly as they affect incentives to maintain or convert natural forests. But readers should not expect detailed or operationally oriented discussions of these topics.

### **This Report's Arguments and Structure**

The report has two parts. The first is diagnostic: it examines the drivers and consequences of deforestation and forest poverty. The second part steps back to see how governance, institutions, and pol-

### Box 3 The World Bank's Forest Strategy

The World Bank's 2004 Forest Strategy and Operational Policy has three interdependent parts:

1. Harnessing the potential of forests to reduce poverty by:
  - Strengthening rights of people—especially marginalized groups—to forests and fostering their participation in forest management.
  - Promoting sustainable forestry, community forestry, and agroforestry.
2. Integrating forests in sustainable economic development by:
  - Improving forest governance and introducing legal and institutional reforms.
  - Encouraging investments that catalyze production of forest products, including environmental services.
3. Protecting local and global environmental values by:
  - Establishing protected areas.
  - Improving forest management in other areas.
  - Developing markets and finance for international public goods such as biodiversity and carbon sequestration, and helping governments create national markets for environmental services from forests.
  - Addressing cross-sector links that affect environmental values.

Source: World Bank 2004.

icies shape those drivers—leading to prescriptions. The line of argument is outlined in figure 1.

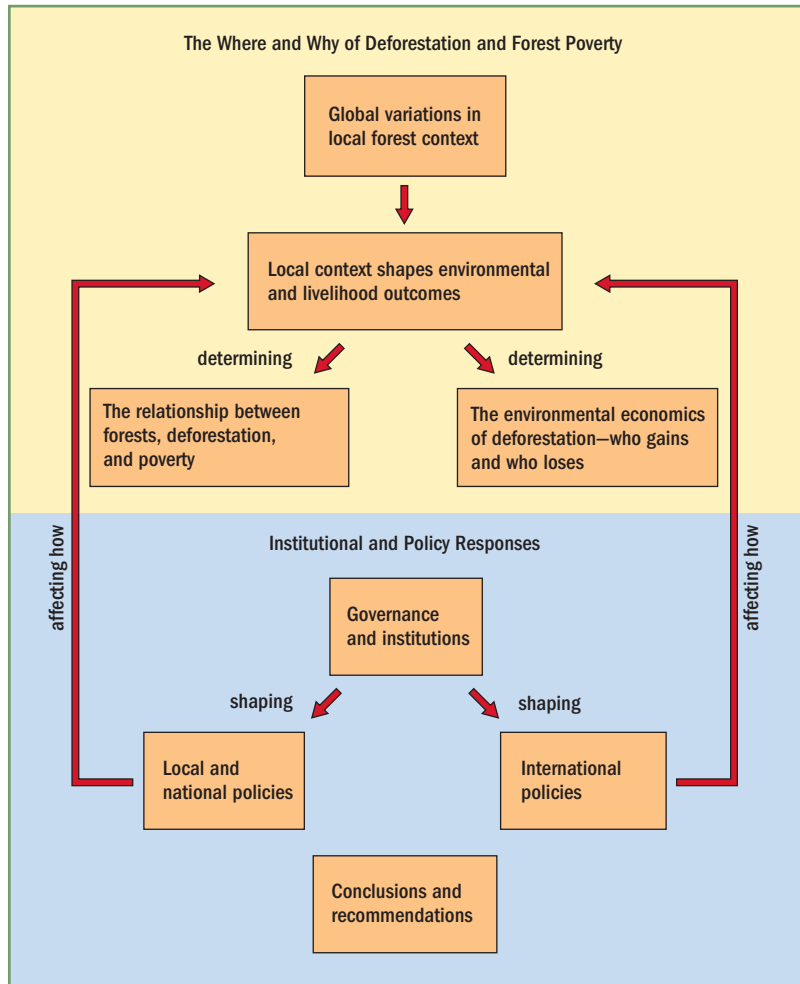
### Forests Differ

Forests differ in the deforestation pressures they face, the extent and depth of poverty they harbor, and the environmental consequences of their conversion. Understanding these differences is essential to prescribing appropriate institutions and policies.

The report distinguishes three stylized forest types:

*Forest-agriculture mosaiclands*—where land ownership is usually better defined, population densities higher, and markets nearer, and natural forest management often cannot compete (from the landholder's perspective) with agriculture or plantation forestry. Although forest is sparse here, deforestation rates are high, and unique biodiversity is threatened.

**Figure 1 Structure of This Report's Arguments**


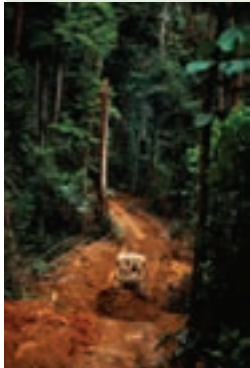



*Frontier and disputed areas*—where pressures for deforestation and degradation are high or increasing, and control is often insecure and in conflict.

*Areas beyond the agricultural frontier*—where there is a lot of forest, few but largely indigenous inhabitants, and some pressure on timber resources.

These different constellations of economic pressures, forest tenure security, and environmental circumstances require different policy responses (see table 1). Table 2 defines the mappable equivalents

**Table 1 Forest Types and Their Challenges**

Type of area	Features	Poverty and development challenge	Environmental challenges	Governance challenges
Mosaiclands with better-defined tenure 	High land value; contain many of the world's forest dwellers but a small fraction of the forest	Managing landscapes for production and environmental services; preventing extinctions of threatened species; mitigating carbon dioxide (CO <sub>2</sub> ) emissions; fostering carbon sequestration		Agreeing on, committing to, and enforcing property rights over land, trees, and environmental services
Frontier and disputed areas 	Agricultural expansion; rapidly increasing land values in frontiers; conflicts over forest use in disputed areas	Fostering more intensive rural development and access to off-farm employment	Avoiding irreversible degradation; mitigating CO <sub>2</sub> emissions; avoiding forest fragmentation	Restraining resource grabs by large actors; averting races for property rights by smallholders; equitably adjudicating land claims
Areas beyond the agricultural frontier 	Most of the world's tropical forests; contains a minority of forest dwellers but many indigenous people	Providing services for dispersed populations	Maintaining large-scale environmental processes	Protecting indigenous people's rights; averting disorderly frontier expansion

of these ideal types. Maps 2, 3, and 4 show their locations (for the tropical forest biomes only), and table 3 tallies their populations.

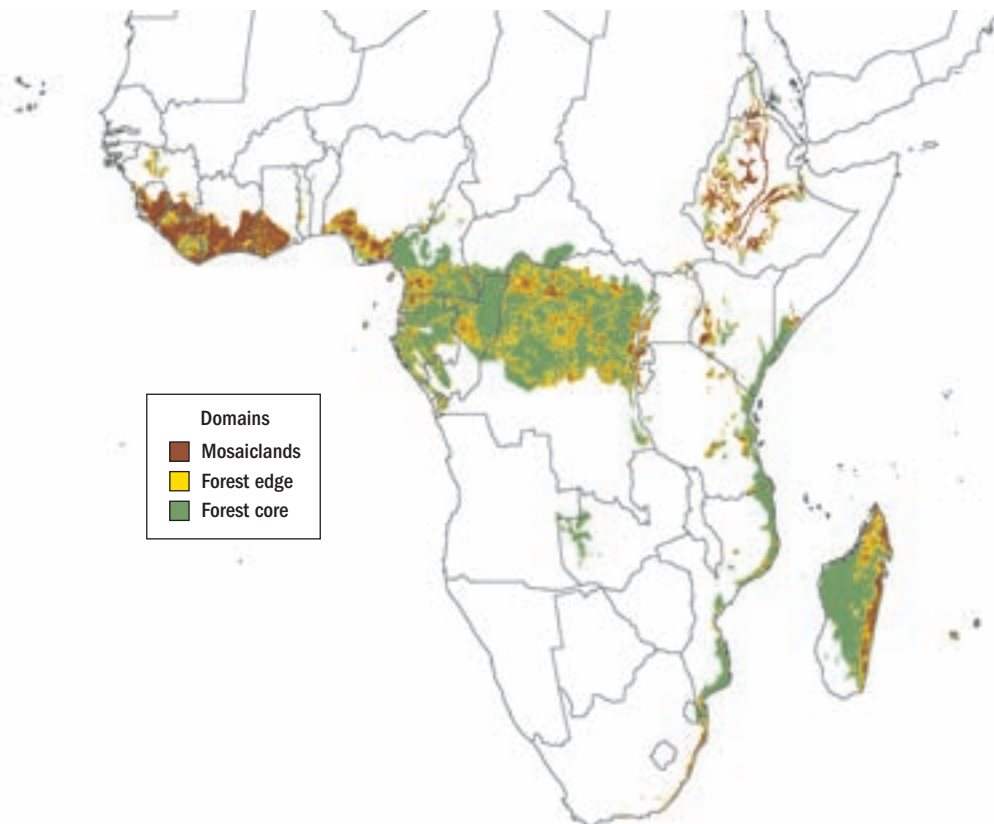
### Incentives and Constraints Shape Forest Outcomes

People clear and log forests because they gain from doing so. Gains can be unsettlingly small or impressively large, ephemeral or sustainable. Local conditions, incentives, and constraints determine where and why deforestation occurs, and with what impacts.

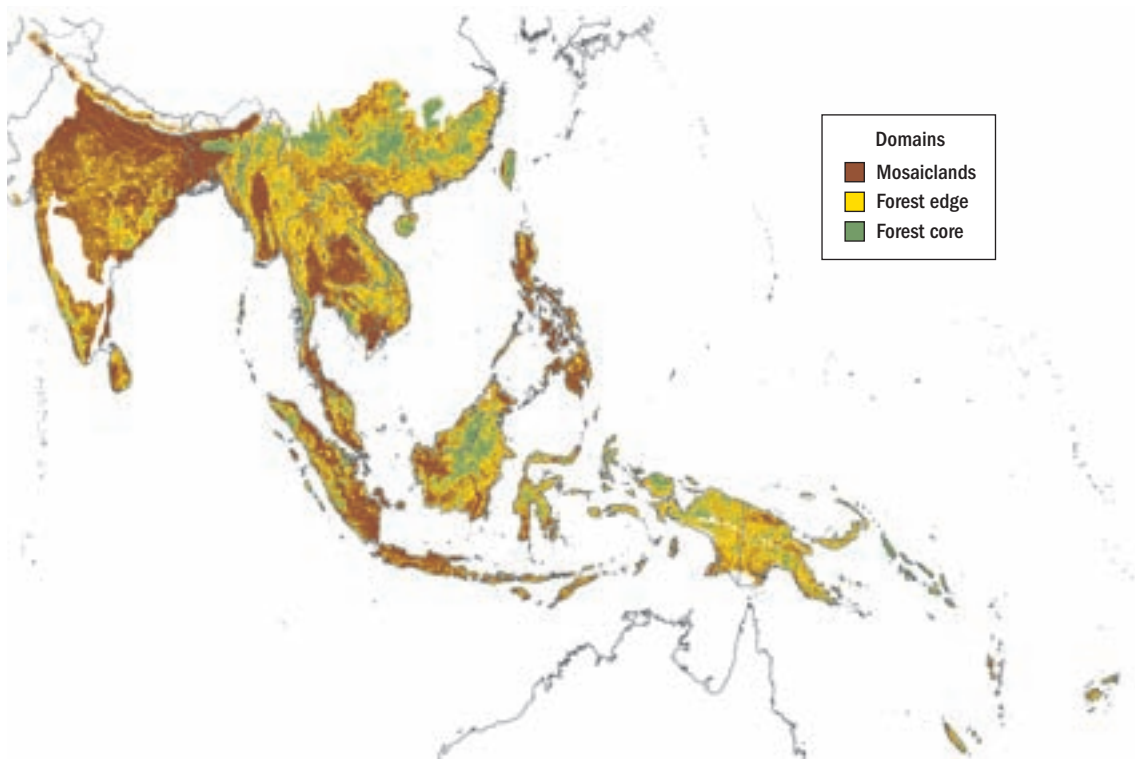
**Table 2 Stylized Forest Types Have Equivalents in Mapped Domains**

Stylized type	Mapped domain
Mosaiclands with better defined tenure	Mosaiclands: agricultural lands, agriculture-forest mosaics, and small forest patches
Frontier and disputed areas	Forest (and savanna) edges: the forested borders of mosaiclands
Areas beyond the agricultural frontier	Forest (and savanna) cores: forested areas well away from mosaiclands

**Map 2 Domains in Africa's Tropical Forest Biomes**



Source: Authors' calculations.

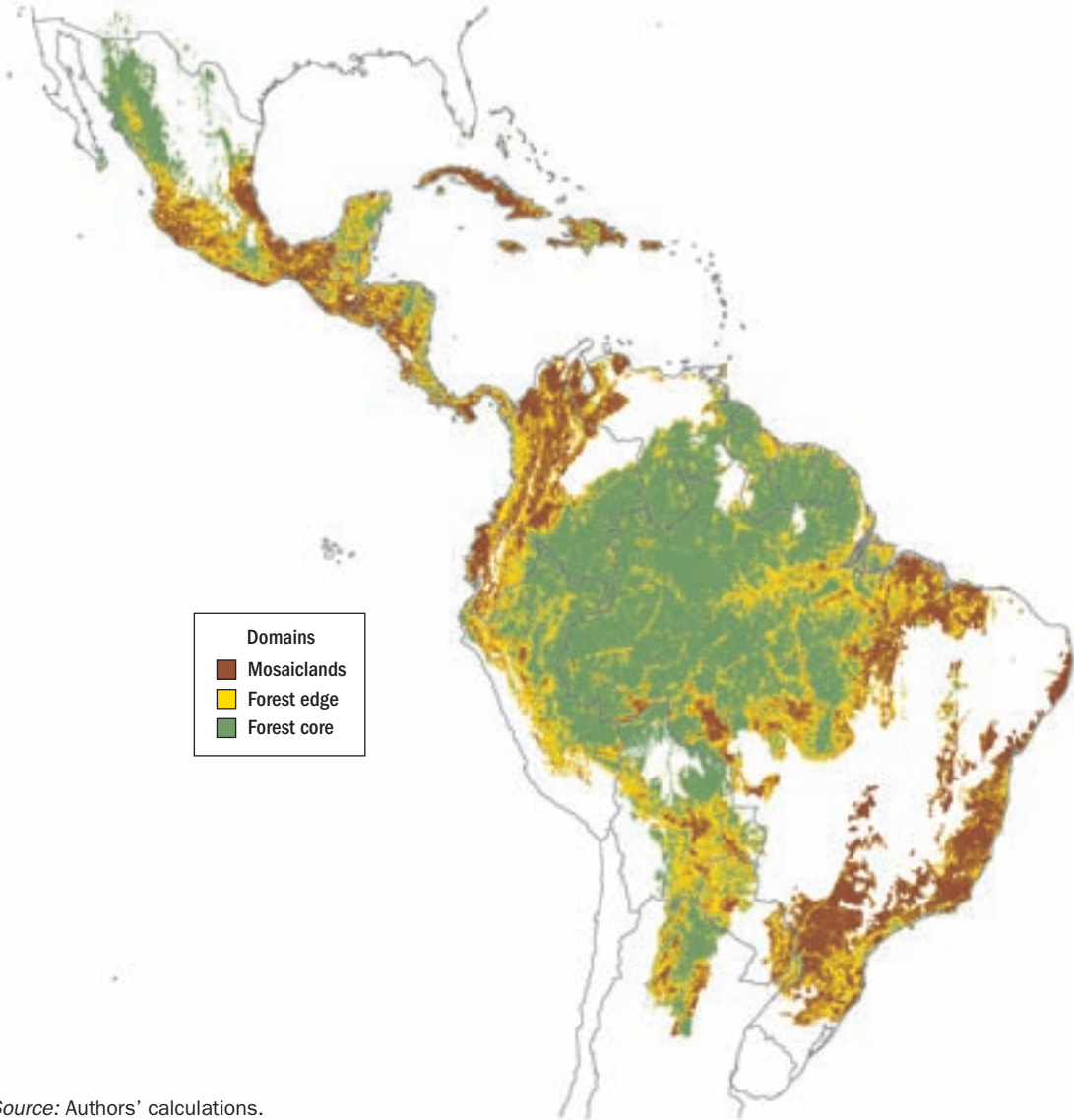
**Map 3 Domains in Asia's Tropical Forest Biomes**

Source: Authors' calculations.

A simple economic framework applies to all forest actors: subsistence households and large companies; farmers, ranchers, and loggers. Landholders and land claimants weigh cultural, economic, and legal considerations when making decisions about land use. A central issue for the report is that some may find agriculture a more profitable, attractive land use than sustainable management of forests for timber and other products. After an initial selective cut of timber, the present value of the next cut—30 years hence—may be only pennies a hectare. Conversion to pasture may offer tens or hundreds of dollars a hectare; conversion to soy or palm oil may offer \$1,500 per hectare or more.

Low wages, good soils, favorable climate, and higher prices for agricultural goods all motivate deforestation. Figure 2 shows that Amazonian deforestation is more rapid in places where the farmgate price of beef is higher. This suggests that road improvements or agricultural policies that boost farm profitability will tend to accelerate

**Map 4 Domains in Latin American and Caribbean Tropical Forest Biomes**



Source: Authors' calculations.

deforestation. In addition, high prices for timber can provoke mining of old-growth forests—though it can also stimulate sustainable management of plantations and secondary forests.

These relationships are strongly affected by governance and tenure conditions. Where governance is weak and tenure poorly

**Table 3 Forest Populations and Areas Vary by Continent, Biome, Domain, and Remoteness, 2000**

		Population (millions)							
Continent	Biome	Mosaiclands				Forest edges		Forest cores	
		Agricultural lands		Mosaic forest					
		Hours to major city		Hours to major city		Hours to major city		Hours to major city	
		< 8	> 8	< 8	> 8	< 8	> 8	< 8	> 8
Africa	Forests	13.2	2.9	25.5	3.6	22.6	7.9	18.3	12.0
	Savannas	55.4	6.9	28.5	3.6	54.3	11.6	58.9	28.8
Asia	Forests	324.1	12.6	71.5	18.6	256.5	29.5	60.9	6.1
	Savannas	4.7	0.0	0.2	0.0	1.8	0.1	0.0	0.0
Latin America and Caribbean	Forests	31.2	3.2	18.2	1.8	34.8	7.2	7.5	3.9
	Savannas	5.2	0.5	2.8	0.3	4.1	1.0	0.7	0.3
All	Forests	368.5	18.6	115.2	24.0	313.9	44.7	86.7	22.0
	Savannas	65.3	7.4	31.5	4.0	60.2	12.7	59.5	29.0

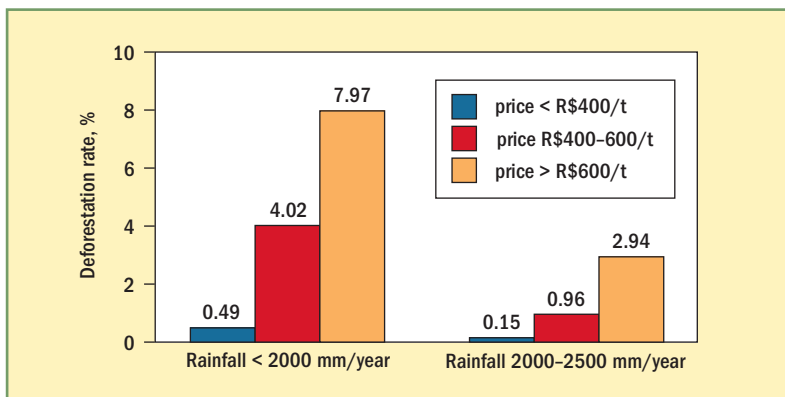
  

		Area (thousands of square kilometers)							
Continent	Biome	Mosaiclands				Forest edges		Forest cores	
		Agricultural lands		Mosaic forest					
		Hours to major city		Hours to major city		Hours to major city		Hours to major city	
		< 8	> 8	< 8	> 8	< 8	> 8	< 8	> 8
Africa	Forests	114	54	440	130	480	466	693	1,206
	Savannas	1,189	480	778	284	1,446	1,012	3,024	4,307
Asia	Forests	1,684	169	636	517	2,045	1,527	594	563
	Savannas	15	1	1	13	8	12	0	3
Latin America and Caribbean	Forests	993	222	922	331	1,622	1,947	647	4,458
	Savannas	566	257	324	170	749	636	259	323
All	Forests	2,792	445	1,998	978	4,148	3,941	1,934	6,226
	Savannas	1,770	737	1,104	467	2,203	1,660	3,283	4,633

Source: Authors' calculations based on CIESIN 2004 and ECJRC 2003.

defined, powerful interests can seize forest resources, and small-holders can engage in conflict-ridden races for property rights. But even landholders with secure tenure may choose deforestation if it offers higher returns.

**Figure 2 Deforestation in Brazilian Amazônia Is Shaped by Rainfall and Farmgate Prices of Beef, 2001–03**



Source: Authors' calculations.

Note: Rate is deforested area/initial forest area.

Excludes protected areas and land reform settlements.

The report uses empirical examples to illustrate aspects of this general framework as they apply in different contexts. The framework helps explain and predict:

- Where deforestation occurs.
- Private gains and public costs of deforestation.
- How a wide range of policies—involving trade, road expansion, forest tenure, and other areas—are modulated by local conditions to affect poverty and environment.
- Why some places experience forest transitions—deforestation followed by recovery in forest cover—while others follow immiserizing paths of deforestation and increasing poverty.

### Poverty in Forests Stems from Remoteness and Lack of Rights

The relationship between forests and poverty eludes simple generalizations. Asserting that poverty causes deforestation, or vice versa, doesn't provide a fruitful framework for understanding the issues.

Empirically, this link is weak. Although poor subsistence farmers cut down trees, so do rich ranchers and plantation owners. Deforestation can deprive poor people of resources—but it can also provide them with sustainable incomes from cash crops. The report

presents new data showing weak, inconsistent geographic overlap among forest cover, deforestation, and poverty in several forested regions (see box 4).

So what is distinctive about forest poverty as opposed to other rural poverty? First, remoteness. Because the best, most accessible farming lands have long been cleared and tilled in many parts of the world, forests and their inhabitants tend to be relegated to remote or unfavorable areas. As a result, areas with high forest cover often have low population densities but high poverty rates (see figure 3, which illustrates this relationship for Nicaragua).

Second, forest dwellers may be unable to tap forest resources. People living in or near forests derive much of their income from collecting fuelwood, food, and other forest products, or by practicing long-fallow agriculture. If they lack the right to harvest forest resources or to use forest land for cropping, their income can suffer. Sometimes this happens when governments or wealthy interests claim forests and restrict access. In other cases forests effectively belong to no one—with the result that their resources are degraded through overuse.

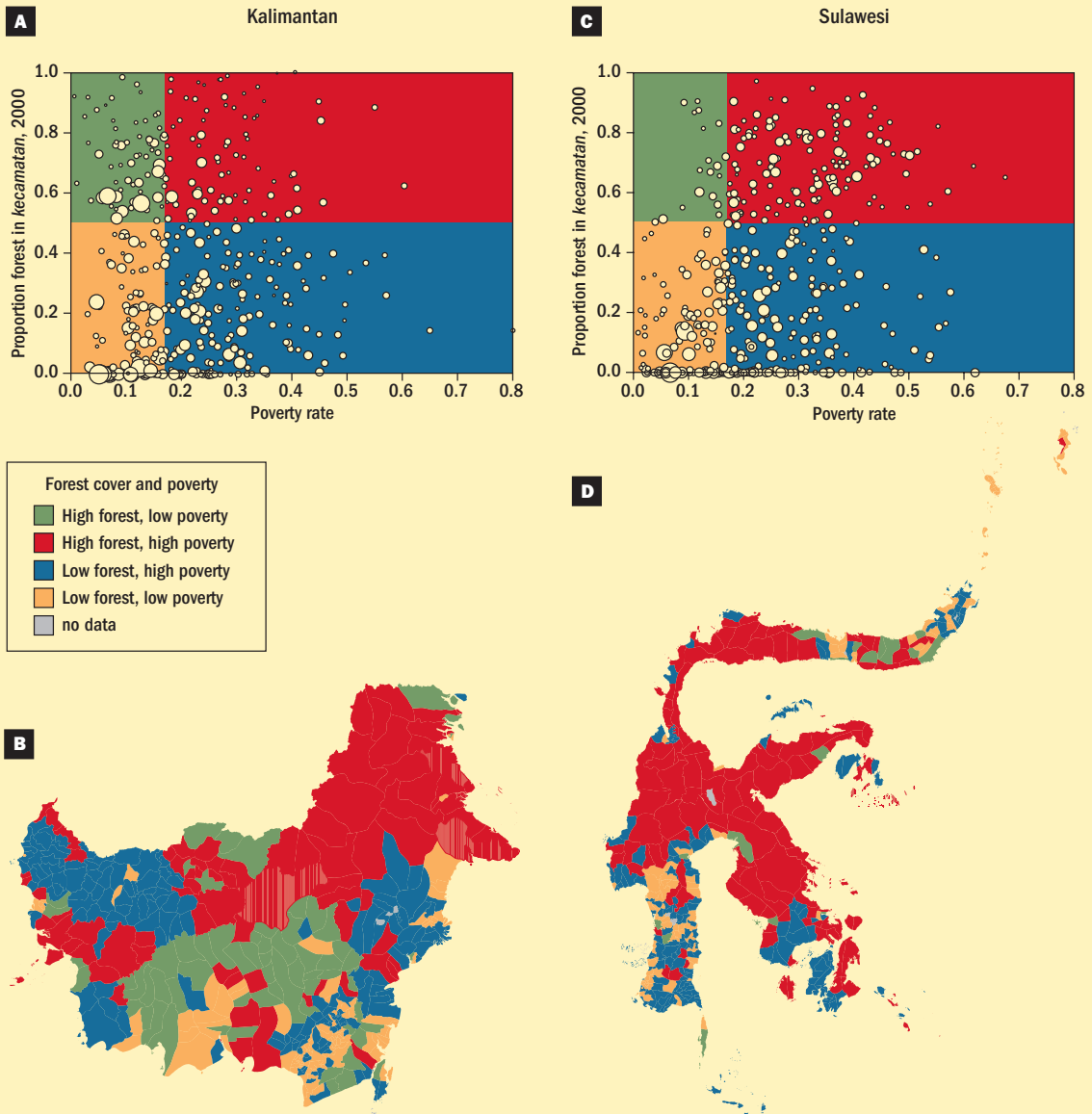
Third, forest dwellers may lack the resources, capacity, and social organization to profit from managing forests for timber or nontimber products.

### **Deforestation Imposes Geographically Varied Environmental Damages**

Environmental problems are social problems, and society may be moved to intervene if one person's land-use decisions significantly affect other people's well-being. Those impacts operate through different channels and depend on the location of deforestation, for instance:

- The most widespread impact—and arguably the one with the most costly damages—is the effect of forest loss on climate change through CO<sub>2</sub> emissions. These greenhouse emissions are associated with all permanent losses of forest, regardless of location. Moreover, their physical impact is reasonably well understood, and society can place an increasingly well-defined economic value on reducing these emissions.
- There is considerable global demand for preventing extinctions and other biodiversity losses, and an increasingly good understanding of where biodiversity is richest and most threatened.

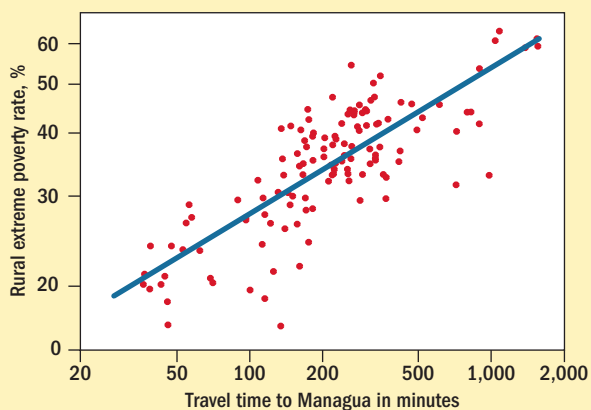
## Box 4 Poverty and Forests in Two Indonesian Islands



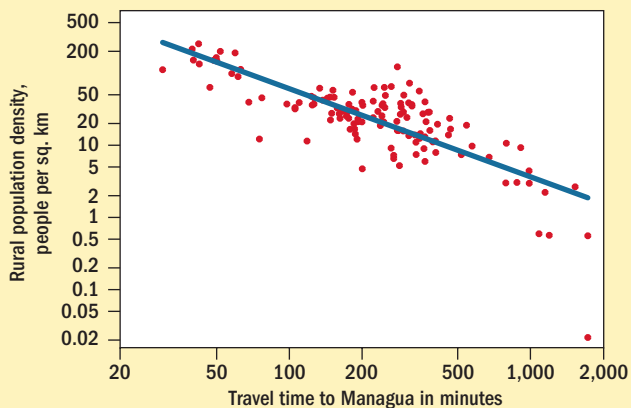
These maps and graphs classify the subdistricts (*kecamatan*) of Kalimantan and Sulawesi according to forest cover and poverty rate. Those with high forest cover and high poverty rates are mapped in red. Those with high forest cover and low poverty rates are mapped in green. In Sulawesi, the remote central areas of the island have high forest cover and high poverty rates (panel D). There are few areas with high forest cover and low poverty rates (panel C, where each subdistrict is shown by a bubble; bigger bubbles indicate more populous subdistricts). Kalimantan, with a more active logging industry, presents a different picture. Here, too, there are remote, high poverty areas. But many highly forested areas have low poverty rates (green areas in panel B). These represent a substantial portion of all people living in highly forested areas (panel A).

**Figure 3 Remoteness, Poverty, and Forest Cover in Nicaragua**

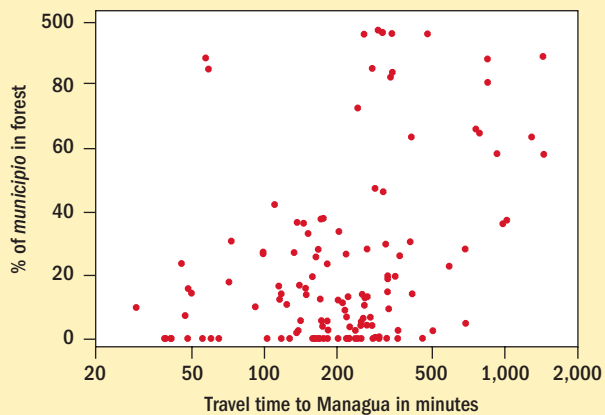
Extreme Rural Poverty Increases with Travel Time to Managua



Rural Population Density Decreases with Travel Time to Managua



Forest Cover Increases with Travel Time to Managua



Source: Chomitz 2004.

Note: Poverty and density graphs exclude Managua department.

- The impacts of forest loss on flooding, smoke pollution, and water availability and quality are important in some locations but specific to local conditions and changes in land use. Protecting local watersheds can be important for maintaining urban water quality.
- Some theories and evidence suggest that deforestation can cause local and global changes in weather patterns quite apart from its effects through CO<sub>2</sub> emissions.
- Direct economic benefits of forest conservation—such as pollination and pest control—are likely to be greatest in mosaiclands but have not been well quantified in physical and economic terms.

### Improving Forest Governance

Diagnosis of forest poverty and environmental issues reveals two basic problems:

- Many forests are nominally owned by governments, but actual control is unclear or disputed. Elsewhere, private and community rights are not respected. Who should have the right to use and manage forests? How can rights be reliably enforced?
- How should the interests of forest owners in removing trees be balanced against the interests of others—near and far—in maintaining the environmental benefits of those trees?

These are problems of governance that require balancing interests between groups, negotiating solutions, and enforcing commitments. But these problems have been difficult to address.

First, elites tend to capture the institutions that allocate forest resources. Second, there are strong asymmetries of information, power, and organization between the beneficiaries of deforestation and those who bear its burdens. The diffuse interest groups favoring forest conservation find it hard to organize themselves to counterbalance the concentrated interests of forest degradation.

Building on a framework introduced in the *World Development Report 2003: Sustainable Development in a Dynamic World* (World Bank 2002), the report describes institutional and technological innovations that might help overcome these two barriers to col-

lective action, thereby facilitating implementation of the prescriptive policies described below. These catalytic innovations—which include building constituencies for conservation and better governance, improving public monitoring and disclosure of forest conditions and management, certifying forest and agricultural products, and introducing more flexible, market-like approaches to environmental regulation—can help diffuse groups organize, check abuses of power, and cut the costs of reaching agreements.

### Balancing Interests at the National Level

Nations need to sort out who has the rights to manage forests and how stringently to regulate those rights in the public interest. The challenges play out differently in different types of forests:

*In mosaiclands*, where agriculture and forests are in close contact, the challenge is to ensure that land managers take into account the benefits of forest maintenance for their neighbors.

*At the frontier and in disputed regions*, to resolve conflicting claims to forestlands and determine where gains from forest conversion outweigh environmental damages.

*Beyond the agricultural frontier*, to recognize and defend long-standing indigenous claims, tap and fairly share rents from timber exploitation while avoiding needless forest degradation, and avert disorderly races for property rights when the frontier arrives.

To realize these goals, governments can deploy the following tools, often in combination:

*Tenure, zoning, and land-use regulation*—revisiting the ownership and management of government lands, implementing systems to enforce property rights, regulating the exploitation of public and private forests, and promoting participatory planning for land management.

*Making forest management more attractive relative to agriculture*—by funding or facilitating markets for environmental services, researching, developing, and disseminating environmentally friendly land management practices, and removing barriers to sustainable management of forests for timber and other products.

*Coordinating regional development interventions* (such as road network expansion and agriculture policies)—to exploit synergies between, or minimize trade-offs between, environmental and livelihood goals.

Table 4 shows possible ways to assign property and use rights in forests. Allocating and enforcing property rights and land-use regulations is not easy, for reasons described earlier: doing so requires settling disputes between groups and enforcing agreements. Nations and regions have sometimes approached this problem through zoning. These efforts have often foundered due to failure to motivate compliance by landholders and to create reliable institutions for resolving disputes and preventing resource capture by elites. Still, some positive examples are emerging.

Different tenure and management regimes are reviewed in the report:

*Protected areas.* The establishment of protected areas is perhaps the longest-standing, most widely practiced, and best-funded approach to maintaining forest environmental services. Evidence suggests that such areas can reduce deforestation even in weak institutional settings. Their effects on livelihoods are less documented, but they have been negative when people have been excluded from protected areas that they relied on for forest products. But there is a trend toward permitting multiple uses for protected areas, and the World Bank has instituted strict social safeguards for their creation. Most new protected forest areas are beyond the agricultural frontier, where it is easier to accommodate local residents, and there is less competition from commercial interests.

*Indigenous areas.* Management and ownership of remote forest areas is increasingly being transferred to indigenous control. Indigenous ownership is sometimes associated with much lower deforestation rates than in comparable areas. But indigenous areas are sometimes prohibited from undertaking commercial logging or large-scale land transformation.

*Regulated logging concessions.* In frontier areas, where land and forests can be profitably exploited, the biodiversity benefits of protected areas come at an opportunity cost. In principle, regulated logging concessions offer considerable

**Table 4 Alternative Bundles of Forest Rights**

Use restrictions	Ownership and/or management		
	State	Community	Private
No restrictions on conversion	State forests zoned for conversion	Some common property	Private lands
Conversion prohibited, sustainable management allowed	Direct state management; forest concessions	Most community forestry	Regulated private forests
Limited or no productive use	Strict protected areas	Some indigenous lands	Private reserves

biodiversity protection at a much lower opportunity cost. Where constituencies for protected areas are weak, establishing regulated logging concessions may be a politically feasible alternative that could be far superior—in environmental terms—to agricultural conversion. Innovations in monitoring and control, including certification, can increase public capture of logging profits and reduce environmental damages associated with logging. Efficient regulation—streamlining regulations to ease the burden of compliance and monitoring costs—can also help.

*Community forest management.* Communities are increasingly sharing management of or taking ownership of public forests. In principle, communities should be better than distant governments at managing and policing their forests, and better suited than individuals to exploit economies of scale in forest management. But successful community management depends on the strength of community organization, the regulations facing communities, and economic and cultural incentives to maintain forests. Communities need strong social capital to enforce compliance with management rules and avoid elite capture of forest resources. Communities may lack the ability to commercially exploit forests or effectively negotiate sales of logging rights to outsiders. Onerous regulations—such as requirements for detailed management plans—can be prohibitively costly. The economics of community management of natural forests can be unfavorable when market access is poor, or the

density of sellable tree species is low. Still, some communities have overcome these obstacles. Policies to support community forestry include building capacity, fostering markets for less-known wood species, and streamlining regulations.

*Privately owned forests.* Reconciling agricultural and environmental services has proven difficult in frontier and mosaiclands. Some countries have applied zoning and forest regulations of varying sophistication. Although rigorous impact evaluations are lacking, these regulations do not appear to be heavily enforced on wealthy interests—but may impose costs on poor people, without generating environmental benefits. Systems for environmental service payments and tradable development rights can help secure landholder cooperation in achieving environmental goals. There may also be scope to organize communities in support of land management goals.

Many rural development and agricultural policies have spillover effects on forests and deforestation. Placement of rural roads is especially important for policy attention because it is under direct policy control (though subject to political pressures). Rural roads can have large effects on both rural incomes and deforestation pressures. Thus careful planning and regulation of road construction, and coordination of road policies with land and forest tenure regularization, can minimize trade-offs between rural incomes and environmental protection. Similarly, policy-induced increases in agricultural commodity prices could benefit rural populations but will tend to increase pressures for forest conversion; these side effects need to be anticipated.

Special attention needs to be paid to the challenges of reducing poverty in remote areas with low population densities. Protecting forest and land rights is a start. Innovative means of delivering services to these areas are also needed.

### **Mobilizing Global Constituencies for Forest Conservation**

While forests have many environmental benefits, only two command a global constituency with potentially large willingness to pay for those benefits: carbon storage and conservation of globally significant biodiversity. Mobilizing global finance for these environmental services is a crucial long-term challenge.

Global carbon finance offers an ungrasped opportunity for mitigating climate change, supporting sustainable land use, and con-

serving forests. About a fifth of global CO<sub>2</sub> emissions come from tropical deforestation—and the costs of abating some of these emissions appear low. In Latin America dense tropical forest is often cleared to create pastures worth a few hundred dollars a hectare, while releasing 500 tons of CO<sub>2</sub> per hectare. This implies, at a societal level, a CO<sub>2</sub> abatement cost of less than \$1 a ton. When other, more profitable, land uses are considered, the abatement cost is still under \$3/ton CO<sub>2</sub> (figure 4).

Meanwhile, some observers think that tackling climate change requires paying about \$3 a ton for CO<sub>2</sub> abatement—and European Union (EU) members are currently paying up to \$20 a ton (though this price is volatile). In other words, deforesters are destroying a carbon storage asset theoretically worth \$1,500–\$10,000 to create a pasture worth \$200–\$500 (per hectare). Yet carbon markets, such as those under the Kyoto Protocol and EU Emissions Trading Scheme, do not reward forestholders for reduced emissions from avoided deforestation.

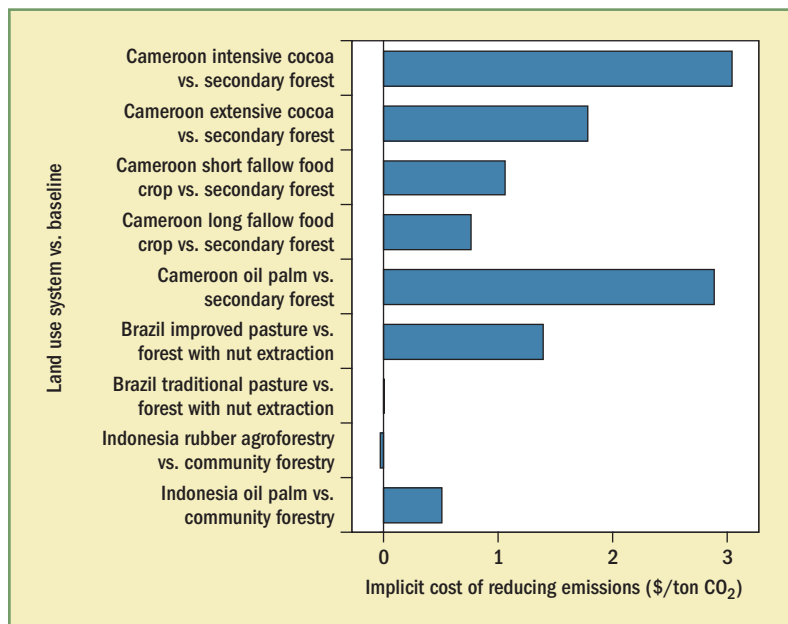
The failure to grasp this opportunity reflects concerns about the implementation of incentive payments for reducing forest emissions. But a long-term approach could address those concerns by:

*Securing global commitment to mitigating climate change*, so that reduced deforestation helps reduce the global cost of arresting rising atmospheric CO<sub>2</sub>. Reduced deforestation must be part of a long-term global package that includes lower industrial and transport emissions and more rapid research and development on clean energy.

*Creating a system of financial incentives*, funded by industrial countries, for developing countries to reduce their forest CO<sub>2</sub> emissions. This might be incorporated, for instance, into a change-climate regime whereby industrial countries could meet more stringent requirements for reducing CO<sub>2</sub> emissions partly by funding national programs to reduce deforestation. Developing countries would receive payments tied to measured reductions in deforestation below some agreed level.

*Developing national infrastructure for forest carbon*—that is, institutions and policies to monitor it and reduce deforestation. In most countries this would be a gradual process. The institutional requirements, though significant, would be consistent with those already required for better forest governance. The policies would not necessarily involve direct payments to for-

**Figure 4 Deforestation Would Be Unprofitable in Many Land Systems at Modest Carbon Prices**



Source: Authors' calculations using data from Tomich and others 2005.

estholders, but would support systems for preventing accidental forest fires, strengthening monitoring and enforcement of regulations, regularizing forest tenure, and increasing returns to forest maintenance relative to agriculture.

*Stimulating production of food and timber on degraded lands.* This is crucial to counteracting leakages (where pressures on protected forests are diverted to unprotected ones), and is an important avenue through which emission reduction programs stimulate sustainable development.

*Providing small payments per ton of CO<sub>2</sub> deferred each year,* rather than large upfront payments for unenforceable commitments to perpetual reductions in CO<sub>2</sub>.

The spatially concentrated nature of threatened biodiversity lends itself to environmental service payments in which landholders would be paid for maintaining habitat quality. Such markets might be particularly apt for mosaiclands—where biodiversity is highly threatened and land tenure is reasonably well defined—and for community forests—where buyers of conservation services might be

able to outbid loggers for concession rights. Auction-based systems for purchasing conservation services have advantages of transparency and efficiency. Such systems could elicit self-assembling biodiversity corridors in biodiversity hotspots where forest remnants persist in areas less attractive to agriculture.

To date there has been no large-scale financing mechanism for payments of this kind. Existing conservation funders—including the Global Environmental Facility (GEF) and nongovernmental organizations (NGOs)—could direct part of their portfolios to such payments. Supplemental funds could be raised if nations, individually or together, create markets for biodiversity offsets to compensate for damages associated with construction, mining, and other projects that harm the environment.

In addition to these long-horizon initiatives, the international community could immediately fund the compilation of information that is critically needed to plan and execute policies for reducing forest poverty and deforestation. Severe but readily remediable information gaps include:

- Rates, locations, and types of deforestation and degradation.
- Poverty levels of forest-dwelling and forest-using populations.
- Monitoring and evaluation of the environmental and economic outcomes of forest conservation projects and policies for devolving forest control.
- Physical and economic impacts of forest conservation on environmental service flows.

## **This Report's Recommendations**

### **International Level**

- Mobilize carbon finance to reduce deforestation and promote sustainable agriculture.
- Mobilize finance for conservation of globally significant biodiversity.
- Finance national and global efforts to monitor forests and evaluate the impacts of forest projects and policies—including devolution of forest control.

- Foster the development of national-level research and evaluation organizations through twinning with established foreign partners.

### National Level

- Create systems for monitoring forest conditions and forest dwellers' welfare, make land and forest allocations and regulations more transparent, and support civil society organizations that monitor regulatory compliance by government, landholders, and forest concessionaires. The prospect of carbon finance can help motivate these efforts.
- Make forest and land use regulations more efficient, reformulating them to minimize monitoring, enforcement, and compliance costs. Economic instruments can help.

### Areas beyond the Frontier

- Avert disruptive races for property rights by equitably assigning ownership, use rights, and stewardship of these lands.
- Options for forest conservation include combinations of indigenous and community rights, protected areas, and forest concessions. Still, some forest may be converted to agriculture where doing so offers high, sustainable returns and does not threaten irreplaceable environmental assets.
- Plan for rational, regulated expansion of road networks—including designation of roadless areas.
- Experiment with new ways of providing services and infrastructure to low-density populations.

### Frontier Areas

- Assign and enforce property rights equitably.
- Plan and control road network expansion.
- Discourage conversion in areas with hydrological hazards, or encourage community management of these watersheds.

- Use remote sensing, enhanced communication networks, and independent observers to monitor logging concessionaires and protect forestholders against encroachers.
- Consider using carbon finance to support government and community efforts to assign and enforce property rights.
- Encourage markets for environmental services in community-owned forests.

### Disputed Areas

- Where forest control is transferred to local communities, build local institutions with upward and downward accountability.
- Where community rights are secure and markets are feasible, provide technical assistance for community forestry.
- Make landholder rights more secure in “forests without trees.”
- When forest tenure is secure, use carbon markets to promote forest regeneration and maintenance.

### Mosaiclands

- Reform regulations so that they don’t penalize tree growing.
- Promote greener agriculture—such as integrated pest management and silvopastoral systems—through research and development, extension efforts, community organization, and reform of agriculture and forest regulations.
- Develop a wide range of markets for environmental services—carbon, biodiversity, water regulation, recreation, and pest control—to support more productive, sustainable land management.

### Conclusions

In the long run, rising wages and urbanization will pull rural people away from marginal lands at the forest edge, halting deforesta-

tion and in some cases resulting in forest regrowth and recovery. But some forests may never recover, and others may irretrievably lose some of their biodiversity. Better institutions for forest management can help bridge the forest transition—preventing deforestation for small and ephemeral gains while providing more sustainable livelihoods.

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