



NI PB 09-09 | June 2009 | www.nicholas.duke.edu/institute

*International Forest Carbon and the Climate Change Challenge Series – Brief No. 5**

Addressing the Causes of Tropical Deforestation Lessons Learned and the Implications for International Forest Carbon Policy

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Key Messages

- Economic incentives for deforestation are strong. Offering economic incentives for conservation should help standing forests better compete with the commodities and infrastructure that drive deforestation.
- Ambiguous property rights and weak governance also drive deforestation. Institutional and property rights reforms (to forests and forest carbon) will require careful attention to ensure positive outcomes for both people and forests. Here the capacity-building efforts of the U.S. and other developed countries could play a helpful role.
- Performance-based approaches offering economic incentives for forest conservation are significantly different from the previous approaches employed over the past 30 years and could yield better results. This new approach would establish clear goals, create positive incentives, foster accountability, and—when coupled with solid evaluation—allow us to learn what works and what doesn't to reduce deforestation and improve livelihoods.
- Engaging indigenous and other forest-dependent communities in programs—through participation in program design, extension of secure property rights, and economic incentives for conservation—should improve the probability of success.
- The U.S. and other developed countries can further promote success by continuing to push for strict controls on the illegal timber trade and reviewing the impacts of biofuels policies and agricultural subsidies on tropical deforestation.

As U.S. policymakers consider inclusion of a mechanism for reducing tropical deforestation in U.S. climate change policy, it is important to review the insights and lessons learned from previous efforts to reduce tropical deforestation. The crisis of deforestation is not new: the international community has been attempting to reduce deforestation rates for decades. But because these efforts have not adequately addressed some of

the principal causes of deforestation—the main one being commercial agriculture—they have seen limited success. We must review what we know about the complicated forces driving land-use change in the tropics in order to design a new mechanism and supporting policies that will be effective.

* Each brief in this series corresponds to a chapter in the Nicholas Institute's report on forest carbon, titled *International Forest Carbon and the Climate Change Challenge: Issues and Options*. The full report, and each brief in the series, can be found at <http://www.nicholas.duke.edu/institute>.

What causes tropical deforestation?

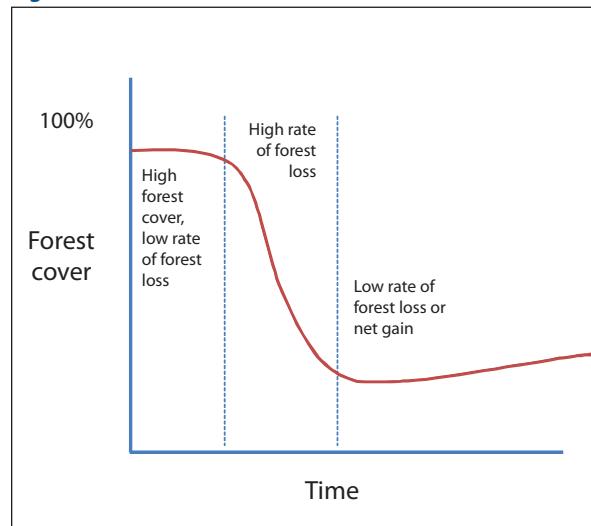
Much of what fuels deforestation comes down to economics. While forests provide many important environmental services to society (e.g., carbon storage, clean water, flood control), these services are not valued in the marketplace. In contrast, timber harvesting and production of agricultural goods on forested lands are highly valued, making forests worth more cut down than standing. In addition to these direct economic incentives, a host of other factors indirectly lead to tropical deforestation: road expansion, insecure property rights, and weak governance, to name a few.¹ The interventions required to address direct and underlying causes of forest clearing will differ, but both must be addressed in order to reduce deforestation.

Global demand for food, wood, and fuel

Commercial agriculture, industrial timber harvesting, fuelwood collection, and small scale agriculture are the primary drivers of tropical deforestation and forest degradation (see Table 5.1).² While small-scale agriculture and wood harvesting do result in deforestation and degradation, in those regions with the highest deforestation rates, the dominant factor causing deforestation is commercial agriculture.³ Industrial timber harvesting is also significant, but because logging in tropical forests is often selective, its direct effects are best described as “degradation,” or a reduction in forest cover. This degradation, however, can eventually lead to deforestation. Degraded forests are also more vulnerable to further exploitation and to fire.⁴

Estimates of deforestation rates vary (see Table 5.1). While the most recent comprehensive study of rainforest loss in the tropics using remotely-sensed data finds that Africa accounts for a small percentage of total rainforest clearing, FAO finds that Africa accounts for a high percentage of total forest loss (rainforest + other

Figure 5.1. Forest transitions over time.



forests and woodlands). This may indicate that large areas of Africa's forests and woodlands not technically considered “rainforests” are being cleared, though methodological differences in the two studies likely also contribute to the discrepancy in deforestation rates.

Pressure on the world's forests will continue to grow. The world's population is expected to increase about 50% to nearly 9 billion by 2050, and most of this growth will be in developing countries.⁷ Around the world, per capita meat consumption has doubled since 1950, and diets rich in meat and dairy require significantly more land than vegetable-based diets.⁸ China is now the world's largest importer of industrial roundlogs, much of it from Papua New Guinea and West and Central Africa.⁹ U.S. demand for tropical wood contributes as well, as the U.S. is the world's largest consumer of wood products. Much of the wood fueling this trade is illegally harvested or of dubious legality.¹⁰ And on top of all of this is a growing demand for biofuels (currently from corn, soy, and palm oil)

Table 5.1. Regional variation in deforestation rates and drivers.

Region	% of total tropical deforestation (rainforests only)*	% of total deforestation in the 3 regions (rainforests + other forests and woodlands)†	Principal direct causes of deforestation	Hotspots*
Latin America	60.4%	39.7%	Industrial cattle ranching and soy plantations	Brazil accounts for an estimated 48% of total tropical rainforest loss
South and Southeast Asia	34.3%	24.9%	Oil palm plantations and industrial logging	Indonesia accounts for an estimated 13% of total tropical rainforest loss
Africa	5.4%	35.4%	Small-scale agriculture and fuelwood harvesting	DRC is attracting more interest from industrial agriculture and logging operations

* Regional and national estimates from the most recent comprehensive study of pan-tropical deforestation rates using remotely-sensed data: Hansen et al. 2008. Humid tropical forest clearing from 2000–2005 quantified by using multitemporal and multiresolution remotely sensed data.⁵

† Regional estimates derived from FAO's 2005 Global Forest Resources Assessment Report, using hectares of forest cleared annually from 2000–2005.⁶

which may already be increasing pressure on tropical forests.¹¹ The future impact of biofuels will likely depend on what extent “second-generation biofuels” (e.g., switchgrass grown on marginal lands, crop residues) are pursued (see concern #4 in Chapter 3 of full report).¹²

In addition to global commodity demand, a suite of additional factors contribute to expansion of agriculture and logging into tropical forests: new roads open remote areas to exploitation and reduce transportation costs, low exchange rates and foreign debt encourage commodity exports, and subsidies lower production costs.¹³ New roads are created not only by planned transportation initiatives, but also by mining projects and oil and natural gas pipelines.¹⁴

A country’s level of economic development affects deforestation rates. There is some evidence that deforestation increases as per capita income increases, before stabilizing and then decreasing, with countries increasing their forest stocks as their citizens grow wealthier (Figure 5.1).¹⁵ While this pattern may vary, it provides a useful framework for understanding deforestation.¹⁶

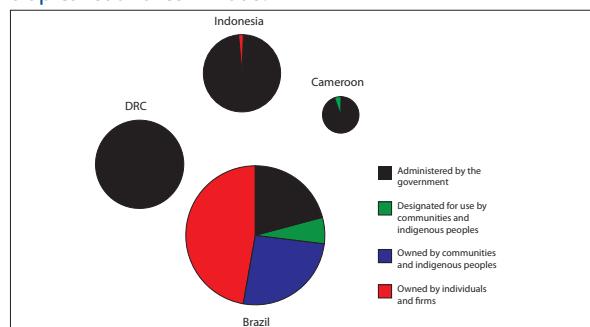
Ambiguous property rights

Forests in developing countries are primarily owned by the state. While many of the communities who reside in these forests claim customary rights or have some access rights to the resource,¹⁷ these rights are often not codified in law. There is significant variation in land rights distribution across countries (Figure 5.2). Uncertainty around property rights makes ownership of carbon even more uncertain. Peruvian law, for example, permits the state to grant rights to private entities and communities to sustainably manage and conserve forests, but not to own forests. It is thus unclear whether those that have been granted these use rights by the state also possess the right to enter into contracts and benefit from possible new international forest carbon policies.¹⁸ Because people living in forests often lack clear rights,¹⁹ they lack the authority to stop new settlers or commercial interests from deforesting. In addition, when long-term rights to the forest are not guaranteed, land users have an incentive for rapid and destructive exploitation rather than sustainable management. In some cases, deforestation is actually a means of establishing land rights.²⁰ All these factors combine to make some areas of tropical forests de facto commons, where deforestation and conflict over contested resources can occur. Secure property rights alone will not reduce deforestation but can be a crucial part of the solution.

Weak governance

Many tropical forest countries have relatively weak governance and government institutions.²¹ The agencies or departments in charge of resource management often have little or conflicted authority, little funding, and little or no transparency in decision-making and revenue flow. Unclear property and access rights, an absence of oversight and accountability, little or no opportunity for recourse or participation in decision-making for local communities (little role for civil society), and corruption are common characteristics of weak governance. Weak governance often leads to short-sighted actions and policies. Governments (or in cases of corruption, individuals within the government) earn significant revenue from commercial exploitation through taxes and fees. Large swaths of tropical forests are zoned for agricultural production, timber and mineral extraction, and hydrocarbon development.²² Even if governments attempt to address issues such as sustainable forestry requirements or illegal logging, agencies often lack the finances to monitor and enforce laws in these vast and remote landscapes. By some estimates, over half of the timber harvested in tropical forests is done so illegally.²³ In some cases government actors play an active role in illegal deforestation. In the Democratic Republic of Congo, for example, weak government capacity, a lack of transparency, armed conflict, and a lack of energy sources for cooking within refugee camps combines to create a situation in which military elites vie for control of a lucrative charcoal trade that clears forests within a national park.²⁴ It is important to note that focusing on legality and enforcement could harm forest-dependent people, since many lack legal title to the lands they

Figure 5.2. Forest ownership distribution in selected tropical countries in 2008.



Source: Data from Sunderlin et al. 2008. *From Exclusion to Ownership? Challenges and Opportunities in Advancing Forest Tenure Reform*. Rights and Resources Initiative Report. http://www.rightsandresources.org/documents/files/doc_736.pdf.

Notes: Pie charts scaled to size of forest area, relative to other countries shown. A small amount of forest area is designated for use by communities and indigenous peoples in Indonesia (0.23 million hectares—less than 1% of the country’s total forest area), which does not show up on this chart.

Table 5.2. Impacts of major multilateral and bilateral tropical forest conservation policy initiatives.

Initiative and status	Description	Deforestation causes addressed	Contributions	Limitations
Multilateral	Tropical Forestry Action Plan (TFAP) Launched in 1985; ended early 1990s	Sought to reduce deforestation and promote sustainable development by formulating national action plans and increasing donor funding.	Timber production and various indirect causes	Doubled the amount of funding for forests and increased donor coordination. ²⁷ Implementation delayed by a top-down structure that did not allow for interventions initiated at project and subnational levels and slowed disbursement of donor funds. It was not clear whether the goal was sustainable development through timber management or reducing deforestation. ²⁸ Deforestation rates increased 40% during the TFAP's first 5 years. ²⁹ Battles over national sovereignty and the participation of forest people and civil society in the design of national plans further weakened political support for the TFAP. ³⁰
	International Tropical Timber Organization (ITTO) Founded in 1985; ongoing	Seeks consensus between supplier and buyer countries of tropical wood on topics related to sustainable forest management.	Timber production	Has developed criteria, indicators, and guidelines for sustainable forest management. Addressing illegal logging has been contentious: explicit mention of "illegal logging" not made in an ITTO agreement until 2006. ³¹
	United Nations Forum on Forests (UNFF) Began in 2001, with precursors at the UN dating back to 1992	Seeks to negotiate an international agreement on forests.	General	Reached an agreement in 2007 to establish a new program for sustainable forest management through 2015 and to move toward a voluntary financing mechanism for forests. Negotiations stymied by disputes between developing and developed countries, including whether developed countries would pay for forest conservation. ³² The 2007 agreement is not legally-binding and does not contain quantitative deforestation reduction targets.
	Forest Law Enforcement and Governance (FLEG) Initiatives Launched 2001; ongoing	Regional roundtables that foster ministerial declarations and processes to cooperatively address illegal logging.	Timber production and weak governance	Fosters regional and international cooperation. Principally addresses the supply and less so the demand for illegal wood. While the EU has a FLEG process to address illegality of their imports, it is through voluntary agreements with individual countries and therefore illegal wood can still enter from or through a country without a voluntary agreement. ³³ There are concerns that focus on legality and enforcement could harm forest-dependent people, since many lack legal title to the lands they have customarily occupied, putting them in a situation of de-facto illegality. ³⁴
Bilateral	Tropical Forest Conservation Act (TFCIA) Passed by Congress in 1998; reauthorized in 2009	Restructures and reduces debt tropical countries owe to U.S. to generate funds in local currency for conservation. Funds managed by national boards, which extend grants to local conservation organizations.	Debt and various indirect causes	Has generated substantial funds for local conservation efforts: 13 agreements projected to generate \$162.5 million. ³⁵ Because funds are received over at least a 10 year period, it is a reliable, long-term source. ³⁶ Contribution to countries' overall debt loads may be minimal in some cases and therefore does not adequately address the deforestation cause targeted by program. ³⁷ Funding has declined in recent years. ³⁸ National conservation programs are often slow to become operational and there is little scientific understanding of on-the-ground conservation impacts.
	Lacey Act Passed by Congress in 1900; amended in May 2008 to expand scope to plant and wood products	Statute originally only addressed illegal wildlife trade. Now it also makes it illegal to import into the U.S. plants that were harvested or traded in violation of the supplier country's laws. This ban applies not only to timber but also to goods containing wood products, such as furniture. Importers are now required to declare the country of origin, quantity, and the plant species of their products.	Illegal logging and U.S. wood and wood product demand	A major regulatory initiative by the largest importer of tropical wood products is significant, but it is too early to evaluate its impact. Supplier country laws may not always be adequate for addressing impacts of logging.

have customarily occupied, putting them in a situation of de-facto illegality.²⁵ Helping countries address weak governance is a critical part of any successful effort at sustainable development or reduced emissions from deforestation.

Previous efforts to reduce tropical deforestation

The U.S. has worked to conserve tropical forests for over two decades through a number of bilateral, multilateral, subnational, and national efforts using various conservation approaches. However, many of these programs have failed to address the leading direct cause of tropical deforestation, global commodity demand. Furthermore, these programs have had difficulty maintaining focus on reducing deforestation

rates. Table 5.2 looks at the limitations and successes of some of the major bilateral and multilateral tropical forest conservation policy initiatives, and Table 5.3 examines the various conservation approaches used over the years.

Assessing the separate impacts of conservation programs is complicated by the lack of rigorous empirical evaluations.²⁶ Traditionally, many conservation programs have reported their impacts in terms of outputs (e.g., the number of people trained) rather than outcomes (e.g., number of hectares of deforestation avoided). But there is growing awareness of the need for rigorous evidence-based evaluations. While the persistence of high tropical deforestation rates could be viewed as evidence that few of these efforts have worked, it is possible that deforestation rates could have

Table 5.3. Strengths and weakness of various conservation approaches.

Approach	Description	Deforestation causes addressed	Strengths	Weaknesses
Protected Areas and Enforcement	Parks, forest reserves, and reducing illegal logging	Focused on timber and clearing for agricultural production	Clear objectives; able to conserve significant amounts of forest when boundaries and rules enforced ⁴⁰	As site-specific interventions, parks may induce deforestation to simply shift to other areas. They can be located in areas of low threat, ⁴¹ and be hampered by weak enforcement capacity. ⁴² Parks sometimes disallow presence of people and force the resettlement of locals. ⁴³
Integrated Conservation and Development Programs	Improving alternative livelihoods and supporting sustainable uses for forest people and communities	Small-scale and subsistence agriculture and wood extraction	Potential to improve livelihoods. Could help conserve forests in those areas where small-scale activities are important causes of deforestation.	Subsistence agriculture and wood harvesting may be important deforestation causes in some landscapes, but minor in others (compared to their commercial counterparts). ⁴⁴ Participants may use new income streams to expand unsustainable practices. ⁴⁵ Not successful without local participation in program design. ⁴⁶
Governance Reforms:	Decentralization of ownership and/or forest management responsibilities to local communities (e.g., community forestry)	Ambiguous land tenure; short-sighted resource use decisions	Provides foundation for sustainable management. There is some evidence that it can be more effective ⁴⁷ and cost-efficient ⁴⁸ than state management.	Without financial incentives for conservation, communities sometimes choose to convert forests to agriculture or engage in unsustainable logging. ⁴⁹ Without democratic and transparent institutions governing management, elite capture can occur at the local level, encouraging unsustainable practices that yield quick profits. ⁵⁰
Payments for Ecosystem Services	Payments to individuals or communities for provisioning of erosion control, carbon sequestration, reduced emissions from deforestation, wildlife habitat, water filtration, etc.	Has potential to address timber harvest and clearing for agriculture by making standing forests more competitive with commodities	Can be effective when payments targeted to those at risk of clearing. ⁵¹ Can be more cost-efficient than indirect approaches. ⁵²	There is a risk of non-additionality (payments for conservation that would have happened anyway). ⁵³ While payments are usually conditional on demonstrated results, this conditionality is monitored and enforced less when payments are made by governments instead of the users of the environmental service. ⁵⁴ Lack of secure tenure limits the participation of many forest communities.

been even higher without these initiatives. Without a counterfactual, or estimation of what would have happened in the absence of the intervention, it is difficult to say conclusively.

Key lessons learned from the major multilateral and bilateral policy initiatives

- ▶ Failing to address global commodity demand greatly limits success.
- ▶ Existing policies and programs can help address underlying causes—reducing debt and imports of illegal wood, and building countries' governance capacity, but are not sufficient to reduce deforestation on their own.
- ▶ Failure to engage indigenous and other forest-dependent people has hampered success.
- ▶ A lack of clear program objectives and evaluation requirements makes it difficult to assess the impacts of

conservation efforts on deforestation, biodiversity, and human welfare.

The U.S. is also involved in tropical forest conservation through traditional overseas development assistance. In 1986, the U.S. Congress amended the Foreign Assistance Act to include Section 118 on tropical forests, recognizing the threat posed to societies from tropical deforestation and directing USAID to support conservation and sustainable forest management activities in the tropics. In fiscal year 2007, USAID funding for tropical forestry programs was \$89.9 million and funding for the U.S. Forest Service Office of International Programs (USFS IP) was \$6.88 million.³⁹ These agencies work in numerous tropical countries to build the capacity of governments and communities to sustainably manage and conserve their forests. These efforts seek to address indirect causes of deforestation, such as weak government capacity, uncertainty over land ownership, and land-use and forestry policy. These programs use a vast array of conservation approaches

(see Table 5.3). Until recently programs to reduce tropical deforestation primarily used protected areas and enforcement, sustainable-use programs, and governance reforms. More recently a Payments for Ecosystem Services (PES) approach has also been tried. Tropical countries will likely employ a combination of these approaches.

Lessons from the principal conservation approaches

- ▶ Failing to address global commodity demand limits success.
- ▶ Site-specific approaches—protected areas, integrated conservation—can have limited impact if deforestation shifts elsewhere.
- ▶ Broader efforts to address economic drivers like PES or national and regional land-use and road planning, removing agricultural subsidies, or clarifying land tenure are likely to have a greater and more cost-effective impact.
- ▶ Conservation tools –protected areas, enforcement, and PES—should target areas at highest risk.
- ▶ Conservation can be hampered by ambiguous property rights that limit the participation of local people.

Implications for a U.S. approach to international forest carbon

The objective of international forest carbon policy is to reduce global GHG emissions by helping developing countries realize a development path where economic growth proceeds in tandem with conservation (for those countries with forests left to lose) or with accelerated regrowth and improved forest management (for those countries that have already lost much of their forest). An understanding of the forces driving tropical deforestation and the lessons learned from previous conservation efforts can offer important insight into how the U.S. might design an effective program to reduce deforestation.

Performance-based programs could yield better results
A consensus has emerged—domestically and internationally—around a results-based approach using carbon finance to reduce deforestation. While early capacity building activities may be more loosely tied to results, the objective is to develop a program where tropical countries demonstrate a reduction in emissions from deforestation below an agreed upon national target or baseline before any payment changes hands. While traditional overseas development assistance

(ODA) has not used results-based approaches, it could certainly establish performance criteria and make continued funding conditional on results. A results-based approach establishes clear goals, creates positive incentives for success, and fosters accountability. Further, a results-based approach would allow us to learn what works and what does not.

Addressing the direct drivers of deforestation is essential

The general idea behind emerging reduced deforestation and forest carbon programs is to change the cost-benefit calculations landowners, companies, and governments make so that standing forests can economically compete with the commodities that drive forest clearing. Given what we know about leakage (see Chapter 4 of full report) and the global nature of demand and supply, it is worth noting that if carbon financing successfully outcompetes agriculture and timber in one location, demand could shift elsewhere—for example to forested countries not participating in the program.

The United States can help in a number of ways. Given that the U.S. is a major buyer of commodities it can have a significant impact by adjusting its contribution to demand (e.g., import controls, biofuels mandate, agricultural subsidies). While the U.S. is beginning to take strong regulatory actions to reduce illegally-harvested wood imports through the Lacey Act, it may be contributing to forest loss through other policies. Recent research suggests that U.S. biofuel policies may be leading to increased forest clearing for soy production in the Amazon.⁵⁵ In addition, the United States can work to coordinate its development assistance across sectors to identify where aid to agricultural and infrastructure sectors are at cross purposes with reduced deforestation programs. And finally, the U.S. can reduce countries' bilateral debts through TFCA and address multilateral debts by paying arrears to the World Bank to fully fund debt relief of countries under the Highly Indebted Poor Countries (HIPC) initiative.⁵⁶

The underlying drivers of deforestation must also be addressed through supporting policies and programs. Complementary efforts to address insecure property rights and governance and institutional reform (for legal, tax, judicial, and natural resource management institutions) will be essential in many countries and will help enhance the efficiency and effectiveness of reduced deforestation programs. New financing beyond the ODA currently directed toward conservation globally will be needed. The U.S. could target existing programs to underlying drivers, but will also likely need supplemental revenues from a climate policy. Importantly, recent bills in the U.S. congress provide

additional support through an allowance set-aside provision.

Allowing early action generates momentum and learning

Previous multilateral efforts show that the international community may take years to reach consensus and implement global policy. The U.S. can act more quickly if it enacts domestic climate legislation that includes international forest carbon, perhaps like that currently under consideration by Congress (see Chapter 2 of full report). The U.S. can even initiate action prior to the enactment of a U.S. program through existing agencies and programs (e.g., assessing existing subsidies and ODA programs, redirecting ODA to best align with forest carbon policies, bringing performance-based measures to the TFCA). To avoid one of the pitfalls of the Tropical Forestry Action Plan (slow startup time due to top-down structure), the U.S. could allow for subnational projects to participate in an international forest carbon program while national capacities and monitoring systems are being built. Such early actions would generate significant learning that could be used to improve future efforts once systems are up and running.

Significant and reliable sources of financing are required

Previous efforts have been unable to generate the levels of funding needed to slow and stop deforestation. It is unclear how much it will actually cost. Estimates based on just the opportunity costs of the alternative land use (i.e., the profits that could be generated from an alternate land use, such as agriculture) indicate a range in the tens of billions of dollars. One recent estimate puts the cost of a 50% reduction in tropical deforestation rates at \$17.2 to \$28.0 billion per year.⁵⁷ And this is likely an underestimate because it does not include transaction or implementation costs. These models also do not adequately capture the feedbacks that might occur between commodity prices and the opportunity costs of taking land out of production.⁵⁸ Traditional ODA flows have been unable to come close to this level. The World Bank reports total international ODA contributions to the forestry sector were roughly \$2 billion per year between 2005 and 2007, \$700 million of which was for forest conservation.⁵⁹ U.S. bilateral ODA (through USAID, USFS IP, TFCA, and the State Department) for tropical forest conservation was just under \$120 million in 2007.⁶⁰ Linking tropical forest conservation to carbon markets, however, could generate unprecedented levels of funding: an estimated \$18–\$85 billion dollars per year⁶¹—getting closer to the potential cost.

New and alternative supplies of energy, wood, and food are needed to satisfy rising demand

To successfully achieve and sustain reductions in deforestation new approaches for meeting rising global and local demand for food, timber and energy will be needed. This will require production systems that use less land by increasing productivity, for example, improved timber and agricultural management. It may also involve the use of high productivity cultivars appropriate to tropical environments. Sustainable agroforestry practices (the incorporation of native trees and forests with agricultural systems) can also conserve high amounts of carbon (and biodiversity).⁶² In addition, marginal lands could be used for carbon sequestration, fuel production and other commodities where the land can sustain such use. Developing more efficient commodity production will be an essential part of national planning for countries that want to engage in forest carbon programs. It is critically important to engage the producers (e.g., timber and agricultural suppliers and buyers). Finding ways to incentivize increased productivity of land use through forest carbon financing and complementary ODA is a critical part of the solution.

Engaging forest communities could enhance program effectiveness

Engaging rather than excluding indigenous and other forest-dependent communities at the outset could avoid costly political battles down the road, which have marred previous forest conservation initiatives. Given their proximity to the resource, forest communities can be effective agents of conservation or of deforestation depending what incentives they are provided. Forest communities could help with enforcement in remote areas by blocking illegal extraction and stopping fires; they could also help provide oversight, improving transparency of financial flows. To achieve cooperation and participation from communities and individuals, programs will need to address property rights and extend sustainable management incentives to forest users. Given that the land where the forest-dependent poor reside will be more valuable than ever in the context of forest carbon programs, countries may resist sharing property rights with forest people. To address these risks, the U.S. could adopt specific policies that uphold internationally-recognized human rights and promote transparency and citizen participation in revenue management, tenure and forest zoning reforms, and national program design and implementation.⁶³ The recent Waxman-Markey bill (HR 2454) includes language regarding protecting and engaging local people and communities.

Conclusion

Deforestation is the product of many complex forces, some of which are very difficult for national governments to control. The results of previous tropical forest conservation efforts indicate that it is hard to stop deforestation. While it is hoped that valuing forests for their avoided carbon emissions will send a sufficient price signal to tropical governments to reduce emissions from deforestation, there is no “magic switch” governments can flip to stop drivers of deforestation. Forest carbon programs need to provide and sustain significant financing and assistance for the design and implementation of alternative development pathways for tropical forest countries. Population and demand for food, wood, and energy will continue to grow. Where possible these forces must be countered by local economic development that involves alternative livelihoods and enhances the efficiency of commodity production.

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The authors acknowledge the support of the David & Lucile Packard Foundation and the helpful comments of Dan Zarin at Packard. We also appreciate the review comments of Evan Notman, Lou Verchot, Christine Johnson, Phil Ovitt, and Brian Murray, as well as the assistance of Paul Brantley of the Nicholas Institute. This policy brief is part of a series of briefs based on the report *International Forest Carbon and the Climate Change Challenge: Issues and Options*. The full report and other briefs are posted on the Nicholas Institute website at <http://www.nicholas.duke.edu/institute>.



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