

CONSERVATION

Reducing tropical deforestation

The interventions required to reduce deforestation differ widely across the tropics

By **Frances Seymour** and **Nancy L. Harris**

Primarily tropical forests continue to be lost at high rates, with disturbing consequences for biodiversity, climate change, and the rights and livelihoods of local communities. Improved spatial data and monitoring systems are enabling researchers to identify drivers of deforestation with increased geographical precision (1) and to assess the relative potential of various interventions to stem forest loss (2). International initiatives currently focus on halting the expansion of commercial agriculture for export markets, a driver of deforestation that emerged in the 1980s (3). Numerous corporations are trying to implement commitments to remove deforestation from their commodity supply chains. However, recent research shows that the drivers of deforestation are complex and can change rapidly. A range of policies customized to specific jurisdictions will be needed to address them effectively.

A COMPLEX RANGE OF DRIVERS

Consideration of the drivers of forest loss in the Brazilian Amazon, the Congo Basin, and Indonesia illustrates the range of drivers that need to be confronted.

In the Brazilian Amazon, cattle ranching is the largest driver of deforestation. Expansion of commercial soy production also drove deforestation in the 1990s, but direct conversion of forest to agro-industrial crops (including soybeans) declined markedly after 2004 (4) (see the figure, top). Now, small-scale clearing exceeds clearing for agro-industrial crops. Conversion of Brazil's pasture land to soy production has also caused indirect land-use change by pushing pasture expansion in Brazil from the Amazon to the Cerrado, as well as elsewhere in South America. Outside Brazil, deforestation is accelerating in Colombia, Paraguay, and Peru. Forests in Brazil have also become drought-prone, which increases their susceptibility to fires, resulting in spikes of fire-related loss in 2005, 2007, and 2010 (see the figure, top) as well as in 2016 and 2017. These disturbances may become more common as climate change brings more frequent and extreme weather events (5).

Deforestation in Africa's Congo Basin has been lower than in the Amazon and is driven by very different economic, political, and social circumstances. Most loss is driven by subsistence and small-scale commercial farmers clearing forests to feed themselves and residents of nearby towns and cities (see the figure, middle) (6). Agriculture is likely to continue to encroach into previously intact forest areas as the region's population expands. Unlike in South America, industrial-scale clearing represents just 1% of all forest loss in the Congo

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Basin. However, industrial agriculture and selective logging have trended upward since 2007 and are likely to expand further.

In Indonesia, deforestation has been driven by complex interactions between selective logging and conversion to industrial oil palm and pulpwood plantations (7). Ten years ago, more than half of Indonesia's deforestation was for the expansion of industrial plantations, but by 2016, this driver accounted for less than 15% of the total (see the figure, bottom). Between 2014 and 2016, small-scale farming drove more than one-quarter of all deforestation. The fires of 2015 accounted for 20% of forests lost that year by transforming them into grass and shrub land (8). Elsewhere in Southeast Asia, deforestation for smallholder agriculture is accelerating.

ACTIONS TO PROTECT RAINFORESTS

Factors that facilitate agricultural development, such as high commodity prices, road building, and rural support payments, accelerate deforestation, whereas establishment of protected areas, law enforcement, the presence of indigenous peoples, and payment for ecosystem services are associated with slowing forest loss (2). Brazil's decade-long reduction in deforestation in the Amazon, which started in 2004, illuminated how the implementation of appropriate policies and private-sector initiatives can have a substantial effect on curbing deforestation. Establishment of new protected areas (including indigenous reserves) across the path

of the advancing agricultural frontier—the “arc of deforestation”—and enhanced law enforcement, aided by remote sensing technology, slowed illegal logging and clearing for cattle pasture. Soy traders, facing potential loss of access to international markets due to advocacy campaigns, imposed a moratorium on sourcing from recently deforested land. The moratorium, augmented by a cutoff of state agricultural credit to municipalities with high deforestation rates, resulted in a decline in forest clearing (see the figure, top).

Inspired in part by their success in the Amazon, international forest campaigners have focused on voluntary commitments by companies that produce, trade, or purchase agricultural commodities to eliminate deforestation from their supply chains. However, the limited impact of corporate commitments to date on deforestation trends has revealed the limitations of private-sector actions and the essential role of government policies and public-sector support (9). The circumstances of each jurisdiction—at both national and sub-national scales—dictate the appropriate mix of policy tools and strategies needed. As a result, many proponents of forest conservation have adopted a new focus on jurisdictional approaches to coordinate initiatives on the part of government, civil society, and private-sector actors (10).

Getting downstream companies to stop sourcing from recently deforested land remains relevant, especially in places that face industrial-scale conversion of forests to produce globally traded commodities. However, complementary strategies to deal with other drivers are also needed. Where smallholders are the main agents of forest clearing, as in the case of cocoa production in Côte d'Ivoire and Ghana, implementation of supply chain commitments needs to be nuanced to provide poor farmers with viable alternatives (11). To be effective and politically palatable, interventions must carefully calibrate positive and negative incentives, and must involve intensive engagement with farmers in partnership with local government. Several initiatives are experimenting with conditioning access to credit, technical assistance, and/or legal title on maintaining and restoring forest area (12). In the Peruvian Amazon, titling indigenous territories combined with restrictions on land use led to a substantial drop in forest disturbance (13).

Spikes in tropical tree cover loss in 2015 and 2016 highlight the increasing vulnerability of forests to fire and the negative feedback loops set in motion by warmer, drier conditions of climate change that exacerbate the impacts of deforestation and forest degradation (5). Fire risk can be reduced by avoiding forest fragmentation and degradation, and in some cases by restoration, the objective of Indonesia's efforts to re-wet peatland forests that have become flammable after having been cleared and drained. In jurisdictions with large areas of relatively intact forests, such as the Indonesian provinces of Papua and West Papua, the emphasis needs to be on planning infrastructure to avoid fragmentation and targeting agricultural development to areas of low conservation value.

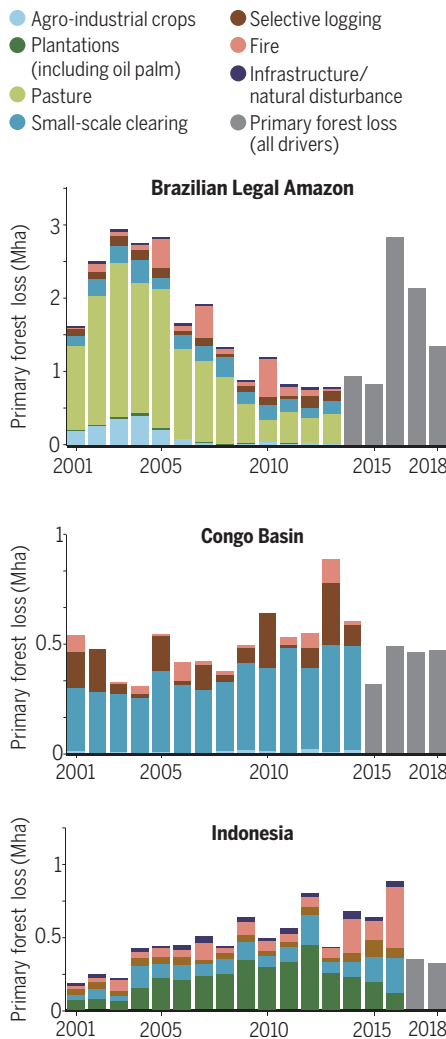
The role of law enforcement in reducing forest loss depends on the nature of the illegal activity, the legitimacy of the law being enforced, and the professionalism of state authorities. When corporate actors or criminal organizations are involved in large-scale clearing in clearly demarcated protected areas, decisive deployment of state force may be appropriate and effective. By contrast, when desperately poor people are clearing forests to survive, rights to land are contested, and/or law enforcement authorities are undisciplined, repressive approaches to forest protection risk violating human rights and inflaming local public opinion against conservation objectives.

MOTIVATING ACTION

Although the drivers and interventions needed to stop deforestation are often clear, effective strategies for prompting political leaders to act to protect forests have proven more elusive. Efforts by the current administration in Brazil to relax forest regulation, and recent increases in tree cover loss in the Amazon, have focused attention on how to maintain—as well as how to introduce—policy reforms. Current international initiatives are underpinned by the assumption that gaining access to finance and markets will motivate action, but this assumption remains largely untested. Reducing Emissions from Deforestation and Forest Degradation (REDD+), the framework for financing forest-based emission reductions negotiated under the United Nations Framework Convention on Climate Change, is based on the premise that the promise of results-based financial rewards will catalyze action by national and subnational leaders. However, both the amounts of funding available and the number of jurisdictions that have secured REDD+ agreements remain small. The jury is still out on the potential potency of such payments (14).

Drivers of deforestation

The main causes of primary forest loss differ widely in different parts of the tropics. See supplementary materials for further details.



Similarly, the current emphasis on the jurisdictional approach to removing deforestation from commodity supply chains rests on the assumption that governments of producer jurisdictions will protect forests to maintain access to environmentally sensitive consumer markets. However, certified sustainable products do not yet command substantial price premiums. For example, the supply of certified sustainable palm oil far exceeds demand. And despite high-profile commitments in 2015 by leading corporations to move toward preferential sourcing from jurisdictions making progress toward reducing deforestation, few steps have been taken in that direction. Further, corporate commitments have not yet translated into political pressure for change in high-deforestation jurisdictions. As long as insensitive (including domestic) markets remain available as alternatives,

this strategy may be limited.

Political decisions to protect forests have often been taken in the wake of natural disasters attributed to forest degradation, such as logging bans imposed in watersheds after catastrophic flooding events. Indonesia's regulation of forest and peatland disturbance intensified after the devastating fires of 2015, which impaired the air quality for millions of its citizens for several months. Accumulating evidence of the potential impact of deforestation on temperature and rainfall, and hence on agriculture (15), should elicit the attention of policymakers if effectively communicated.

For tropical forest protection to become a viable political proposition for elected officials, financial and market incentives must be augmented by increased public awareness of the many benefits that forests provide, locally as well as globally. Building such awareness through better communication of the science is an essential complement to our increasingly sophisticated understanding of why tropical forests are being destroyed. ■

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