Reducing deforestation:
The land-use revolution

Adopting a more sustainable approach to managing forest reserves is a complex challenge. But by putting five critical building blocks into place, the international community can help REDD+ advance from concept to reality.

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The Intergovernmental Panel on Climate Change estimates that deforestation and forest degradation, along with resulting changes in land use, are responsible for 17 percent of global greenhouse-gas (GHG) emissions.[1] Many observers of climate talks see REDD+,[2] the United Nations–sanctioned program to reduce these GHG emissions, as one of the most promising areas for international efforts to achieve near-term successes. A relatively cost-effective mitigation option, REDD+ may offer significant additional benefits, including the preservation and enhancement of ecosystem services[3] that sustain local communities and the world at large.

By accelerating the transition from net deforestation to net reforestation, REDD+ presents forest countries with an option to more tightly align their national-development choices with the global need for climate action and biodiversity stewardship. But for REDD+ to succeed, it must be understood as more than just a framework focused on forests and the rate of deforestation. Rather, it should be considered within the broader context of economic development.

This is consistent with the program's overall mission, since REDD+ is ultimately an effort by the international community to support

heavily forested poor or middle-income countries in making different economic-development choices than most countries have made in the past. In other words, REDD+ should be understood as a mechanism to empower forest countries to pursue alternative development pathways that are not only environmentally sustainable but also economically, politically, and socially sustainable.

To be sure, the path forward will require enlightened and determined political leadership from both developing- and developed-country leaders. Adopting a more sustainable approach to managing forest reserves and a more climate-compatible development model will inevitably disrupt existing political, institutional, and economic arrangements. New alliances will have to be built to include often-overlooked forest-based communities. Some reshuffling of institutional authority is likely. And to achieve REDD+ success at scale, developed countries will have to contribute ample financial and technical support, underpinned by a spirit of partnership.

The objective of this article is to reflect on some of the key challenges to implementing REDD+ and to share insights from our experience supporting public- and social-sector institutions working to take REDD+ from concept to reality.

REDD+ challenges

REDD+ was initially conceived to enable the international community to allocate economic resources to forest countries in ways that would make standing forests more valuable than cut ones. In fact, most deforestation activities seem to generate limited overall economic benefits for the countries where deforestation happens, particularly when the loss of natural capital from forests is taken into account.[4] Yet developing winning REDD+ strategies has proved challenging. Here we discuss four principal challenges we have encountered while working with countries that have pursued REDD+ solutions: market economics of deforestation; nonmarket drivers of land-use choices; capability, coordination, and information; and international commitment.

Market economics of deforestation

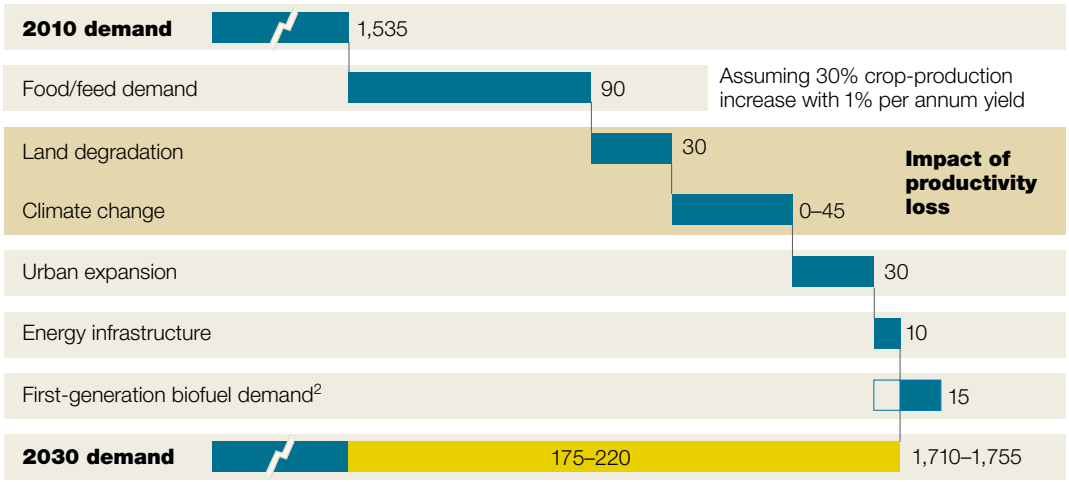
For a number of reasons, countries often have difficulty designing effective incentive systems to prevent the loss of forests. In some cases, deforestation can enable compelling market-based returns, particularly given the opportunities that have emerged for alternative uses of forested land as agricultural commodity prices have skyrocketed. For example, at current prices for crude palm oil, a palm-oil plantation with typical productivity can generate average annual revenues of $4,500 to $5,400 per hectare,[5] which provides a net present value (NPV) of $5,000 to $17,000 per hectare, depending on conversion costs and productivity assumptions.

Compare this with the expected returns from generating revenues from REDD credits on preserved forest. The average reduction in biomass carbon stock between a tropical rainforest and a mature palm-oil plantation on mineral soil is about 150 metric tons of carbon (tC) per hectare or about 550 metric tons of carbon dioxide equivalent (tCO_2e).[6] The NPV of not deforesting a hectare at a price of $5 per tCO_2e (the interim price used in the 2009 Guyana-Norway Agreement)[7] would be about $2,750, which is only about half of the lower range for the

Exhibit

To meet 2030 food, feed, and fuel demand, 175 million to 220 million hectares of additional cropland would be required.

Base-case cropland demand[1] by 2030
Million hectares



[1]Defined as arable land and permanent crops by the Food and Agriculture Organization (FAO) of the United Nations.
[2]As 30–80% of biomass input for biofuel production is fed back to livestock feed, the cropland required to produce feed crops would be reduced by about 10 million hectares.

Source: International Institute for Applied Systems Analysis; FAO; International Food Policy Research Institute; Intergovernmental Panel on Climate Change; Global Land Degradation Assessment; World Bank; McKinsey analysis

NPV of palm-oil conversion. The gap would likely be even wider for the extraction of high-value mineral resources like gold or petroleum. This admittedly simplistic analysis illustrates the difficulties countries may encounter in their efforts to devise simple incentive models that encourage landowners or concession holders to forgo development in exchange for REDD+ payments. It also suggests that approaches based purely on "buying out" deforestation activities may not be realistic in the absence of a sharp and sustained increase in the price of forest-carbon credits.

Unless the world takes action, dynamics such as these are likely to endure. Our recent report indicates[8] that unless crop yields and productivity are substantially improved, an additional 175 million to 220 million hectares of cropland will be needed globally by 2030 to satisfy increasing demand for food, animal feed, and fuel (exhibit). While there are opportunities to bring non-forest land under production, the tendency in the tropics has been to clear primary forests when additional land is needed for agricultural purposes.[9]

Nonmarket drivers of land-use choices

Deforestation and forest-degradation activities can also be compelling for specific interests or population segments, regardless of market returns. For some segments of the rural poor, forests provide access to essential sources of food, energy, or income that cannot be readily obtained elsewhere. This is particularly true in the poorest countries where deforestation rates are highest, such as in Haiti, where trees are cut to produce charcoal, which is then used as primary source of domestic fuel.

In other cases, deforestation has been used as a strategy for acquiring or securing a title to land. This is often the case in Brazil, where ranchers engage in deforestation not only to clear land to raise cattle but also to take possession of land to which they would otherwise have no legal claim. The same is true for the Dayak people of Central Kalimantan in Indonesia, who fell trees and plant rubber as a proxy for land title.

In such cases, REDD+ payments could provide financial flows comparable with or even superior to those generated by land-use activities that are enabled by deforestation or degradation. But payments are unlikely to be effective unless local institutional, political, and economic conditions change to account for other motivating factors such as land ownership. This requires reconciling the competing interests of multiple stakeholders, who often come to the table with a history of mutual distrust and in the context of weak governance. In the cases where it is necessary to navigate competing claims on land tenure among indigenous people, settlers, and governments, the challenge is to develop REDD+ strategies that benefit all stakeholders.

Capability, coordination, and information

The adoption of a more sustainable approach to development in forest-heavy geographies requires a multitude of new skills and capabilities, as well as coordinating mechanisms, which sometimes necessitate new institutions. Governments should develop new ways of thinking and new capabilities for critical functions such as economic strategy, infrastructure planning, fiscal policy, and spatial planning, though they should be mindful that doing so takes time. In many countries, a principal obstacle to the success of REDD+ projects is the knowledge gap between private-sector investors and relevant agencies in local governments.

Progress is further impeded by a lack of clear information about land use, rights, and regulations in many forest countries. In some cases, land ownership may be unclear because countries lack reliable land registries. Rules governing land use may be ambiguous, particularly when different authorities use different maps to delimit land-management units. And information about land cover can be difficult to obtain. A number of new remote-sensing technologies have been developed in recent years, but it remains difficult to obtain information that is sufficiently detailed and precise to be useful at the operational level.

These problems were put in stark relief by the technical challenges that beset last year's Indonesian moratorium on new forestry concessions. The decision also gave rise to extensive discussion about which maps could be used to delimit the moratorium areas. It was subsequently revealed that the Ministry of Forestry, the Ministry of Environment, and the

participating nongovernmental organizations use different criteria to define primary and secondary forests, and thus often had different and conflicting ideas about which areas were covered by the moratorium. Similar problems have hindered reviews of special agricultural leases in Papua New Guinea, where a lack of coordination among the different government agencies involved with land affairs makes it difficult for stakeholders to understand the terms of particular leases.

International commitment

Finally, progress is impeded by the apparent absence of international economic support for REDD+ at the scale required for success. The 2010 Oslo Climate and Forest Conference brought forward substantial pledges for interim REDD+ finance, totaling about $4 billion. The Voluntary REDD+ Database[10] reports additional REDD+ financing commitments of $1.6 billion per year from 2012 to 2014. These commitments are important, but they constitute only a small portion of overall financial flows generated by agriculture and commodity markets. Added together, they roughly equal the value of annual revenues generated by the world's top-five tropical-log exporters. To provide further contrast, in 2010, Brazilian beef and soy exporters generated annual revenues of $15 billion and Indonesian and Malaysian palm-oil exporters generated $27 billion.[11]

Many major REDD+ initiatives remain undercapitalized, and many developing-country stakeholders perceive disbursement of international REDD+ public finance as slow and unreliable.[12] For example, recent reports show that two primary REDD-readiness multilateral processes, the Forest Carbon Partnership Facility and the UN-REDD Programme, have so far disbursed only a fraction of their funds to REDD+ countries.

Many developing-country stakeholders also complain that existing REDD+ funding mechanisms are based on traditional models for overseas development assistance (ODA) and as such are unsuitable for meeting the broadly defined REDD+ challenge. These stakeholders argue that criteria for use of donor funds currently earmarked for REDD+ purposes are too narrowly focused, give too little weight to the priorities of host governments, and underemphasize capability building.

The delay in disbursement of funds is compounded by the uncertainty about the emergence of "at scale" funding mechanisms for REDD+. In the United States, efforts to establish a carbon market based on national-level cap-and-trade have been deferred indefinitely, and uncertainty about the nature of the United Nations Framework Convention on Climate Change (UNFCCC) mechanism for REDD+ remains high. These and other variables have so far discouraged serious engagement by the private sector in REDD+

efforts beyond participation in voluntary carbon-market projects.

The international commitment required for REDD+ success is not limited to donor agencies; consumers also need to play a role. Important efforts have been launched to address the demand side, but REDD+ strategies could benefit significantly from initiatives that increase demand for sustainably produced commodities, particularly through expanded use of certification. Since 2000, the world's certified forest area has increased from 32 million hectares to 240 million hectares (although most of these certified forest lands are located in North America and Europe).[13] And the area certified by the Roundtable on Sustainable Palm Oil increased from about 100,000 hectares in 2008 to more than 1.1 million hectares in 2011.[14] Yet certification programs only account for a small portion of total commodities traded. It has been difficult for some certified commodities to capture attractive price premiums, and uptake remains challenging. Progressive companies could be in a position to develop innovative operational and supply-chain practices that reduce costs and increase uptake.

A model for green growth

These are formidable challenges, but they can be met with a high level of commitment and leadership. Of course, there is still much to learn about how to accomplish REDD+ goals, not least to ensure adequate input rights and benefits for indigenous peoples and forest communities. But a number of promising insights are emerging. It seems increasingly clear that defining REDD+ as merely a system of payments for reduced deforestation is unlikely to achieve sustained impact; rather, long-term success will depend on the ability to embed REDD+ within national-development plans that enable robust economic growth from activities that leave behind smaller carbon footprints.

We highlight five building blocks required at national and subnational levels to deliver against the broadly defined REDD+ challenge: green-growth planning, agricultural productivity, data and technology, REDD+ finance, and capacity and institution building.

Green-growth planning

The success of REDD+ will hinge on the ability to create development plans that not only mitigate GHG emissions and protect biodiversity but also expand economic and employment opportunities, increase food security, and improve standards of living (for example, by expanding access to education, safe water, energy, and financial services).

Our experience suggests that some of the most important initiatives within such plans include opportunities that increase adoption of sustainable agricultural practices, divert development of agricultural or other plantations away from forests and onto idle or degraded land, alter conventional logging practices to minimize their impact on forest management, and reduce consumption of wood as fuel. Many of these initiatives are still relatively new, so examples of their implementation at scale may be limited. But several forest countries have begun the process of building REDD+ strategies that prioritize protection of the environment, stakeholder engagement, and economic development.

For example, in Indonesia, the National REDD+ Task Force developed a draft REDD+ strategy

that has been distributed to different stakeholder groups, which were asked to provide comments. Some of the Indonesian provinces with the highest GHG emissions, such as East Kalimantan, Central Kalimantan, Papua, Aceh, and Jambi, have developed or are developing their own green-growth strategies and action plans. And in Guyana, under the leadership of the country's former president and with support from the government of Norway, an ambitious low-carbon development strategy has been developed to drive a cross-sector transition to a green economy; this includes investments in renewable energy, sustainable agriculture, rural energy access, and rural education.

Agricultural productivity

As noted, one critical step to reduce pressure on forests is to improve productivity of land use in areas that are already cultivated. Our research indicates that best-practice applications in commercial farming could increase crop yields by 20 percent over base-case outcomes from 2011 to 2030. Achieving such productivity gains would be equivalent to freeing up more than 150 million hectares of land. Smallholders could make even larger strides, potentially increasing their productivity by 60 to 70 percent by adopting proven techniques.[15] We believe smallholders could free up the equivalent of an additional 75 million to 105 million hectares by pursuing crop-yield improvements, even accounting for the fact that many will not be able to make use of all the available technologies.[16]

An opportunity on a similar scale could be achieved through improved spatial planning[17] and better use of degraded or abandoned land that has already been cleared. While there is considerable debate about the extent of degraded or nonforested land available for agricultural use, the World Bank and the International Institute for Applied Systems Analysis estimate that there are still 450 million hectares of land that is uncultivated, unforested, and potentially productive, and hence potentially available for cultivation.[18]

Building and scaling up livelihood-improvement programs that successfully engage stakeholders—especially smallholders, forest people, and indigenous communities—is clearly a great challenge. But a number of countries have launched promising efforts to improve the agricultural productivity of smallholders. For example, the Moroccan government developed an aggregation program that involves leasing farmland to commercial farmers who are committed to working with local smallholders through an "outgrower" program.[19] An agricultural-development agency encourages and directs these efforts, ensuring equity in the relationship between outgrowers and commercial farmers. More than 30 aggregation partnerships have been launched since the program began.[20]

In Indonesia, a so-called nucleus-and-plasma scheme obliges large-scale producers of commodities such as palm oil to buy a certain

percentage of their production from nearby smallholders. This provides an incentive to the larger players to support smallholders with better seeds, improved irrigation techniques, and other capacity-building actions. Such models could be incorporated more broadly in REDD+ strategies to support sustainable intensification of agriculture and yield increases by smallholders; the models could also be incorporated into community forestry and other smallholder agroforestry programs.

Data and technology

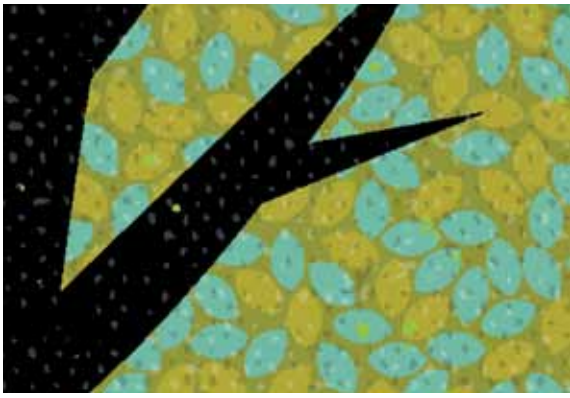
A solid fact base must take into account the economic-development needs that drive deforestation. Once such a fact base is established, stakeholders can begin to quantify the impact of their efforts relative to business-as-usual scenarios and build a shared understanding of the trade-offs implied in shifting to a climate-compatible path to growth. The fact base can also be used to help prioritize given limited strategic and financing capacity, ensuring that resources are focused on the opportunities that hold the greatest promise from the perspective of social and environmental benefits and feasibility.

At the international level, new applications of satellite and aerial remote sensing are emerging that make forest-carbon mapping and monitoring substantially easier. In 2011, NASA's Jet Propulsion Laboratory published a new set of pantropical maps of forest carbon,[21] and another set of maps prepared by the Woods Hole Research Center was published in 2012.[22] Moreover, the Planetary Skin Institute's Automated Land Change Evaluations, Reporting, and Tracking System (ALERTS) platform now enables global tracking of land-use changes in near real time.

REDD+ finance

Prompt and effective deployment of REDD+ public finance remains a challenge, and donor coordination is often more an aspiration than a reality. But there are encouraging instances of national and international commitment and strong leadership driving toward new models of REDD+ finance that could work at scale.

The phased approach that is described in the *REDD options assessment report*,[23] which was further developed by the Informal Working Group on Interim Finance for REDD+ (IWG-IFR), has now been adopted by the UNFCCC as part of the Cancun Agreements. The Amazon Fund in Brazil and the bilateral REDD+ agreements between Norway and Guyana and between Norway and Indonesia are creating living laboratories for the kind of support envisioned by the IWG-IFR. As part of their partnerships with Norway, both Guyana and Indonesia have designed their programs so that they are globally relevant and replicable—and also so that performance can be monitored and codified.



The speed and scale of REDD+ finance is increasing. It is estimated that total forest-directed ODA grew by almost 50 percent from 2000 to 2007, and individual REDD+ initiatives represent a significant fraction of the total ODA to the sector.[24] Moreover, there is considerable hope that the new generation of REDD+ financing models—such as the Green Climate Fund or the REDD+ funding mechanism being developed through the Indonesia-Norway partnership—can improve on traditional ODA models by ensuring adequate host-government ownership and context-specific safeguard regimes.

Capacity and institution building

Capacity is being developed at the national and subnational levels in key REDD+ countries, although much more needs to be done. Green-growth development is by definition a multisectoral, multiministry challenge requiring robust policy-coordination mechanisms. The institutional adjustments required for REDD+ success are still in relatively early stages, but some encouraging examples are beginning to emerge.

In Indonesia, the National Council on Climate Change (DNPI) is bringing new rigor to processes for assessing GHG emission levels and abatement potential in different sectors. The DNPI is also coordinating a multisector measurement, reporting, and verification blueprint. In East Kalimantan, the Provincial Council on Climate Change is leading the charge to identify plots of degraded land suitable for large-scale cultivation and to reform spatial-planning procedures. Other provinces in Indonesia have recently established councils for climate-change coordination or are looking to do so.

Papua New Guinea has established an Office of Climate Change and Development that is advancing an ambitious forest-monitoring agenda in collaboration with the country's governmental bodies, other stakeholders, and the UN-REDD program.

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More work is needed to develop effective approaches that incorporate important non-carbon issues, such as the protection of biodiversity and indigenous land rights, into the design and implementation of REDD+ strategies. The international community still lacks a model for international forest financing that is backed by pledges many REDD+ countries will perceive as credible and that is nimble enough to deliver necessary resources in a timely fashion. But it should also be remembered that the international community has made significant progress on many fronts in the past five years—and much more progress can be made when all stakeholders engage in a spirit of partnership.

[1] This figure is based on the fourth assessment report of the Intergovernmental Panel on Climate Change (IPCC), which estimated forestry's contribution to global greenhouse-gas emissions at 17 percent (see R. K. Pachauri and A. Reisinger (editors), *Climate change 2007: Synthesis report*, IPCC, 2007 (www.ipcc.ch)). In 2009, the figure was estimated to be 12 to 15 percent, depending on the contribution of tropical peatland forests, according to G. R. van der Werf et al., "CO_2 emissions from forest loss," *Nature Geoscience*, 2009, Volume 2, pp. 737–8.

[2] According to the UN-REDD Programme Web site, "Reducing Emissions from Deforestation and Forest Degradation (REDD) is an effort to create a financial value for the carbon stored in forests, offering incentives for developing countries to reduce emissions from forested lands and invest in low-carbon paths to sustainable development. 'REDD+' goes beyond deforestation and forest degradation, and includes the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks" (www.un-redd.org).

[3] The benefits that natural ecosystems supply to humankind are known as "ecosystem services"; this includes, for example, products such as clean drinking water and processes such as the decomposition of waste.
[4] At the microeconomic level, this point is supported by the low opportunity cost of most drivers of deforestation, as described in our own work and by many others. Similar results are found through empirical analysis of human-development indexes in municipalities that have experienced deforestation, as described in Ana S. L. Rodrigues et al., "Boom-and-bust development patterns across the Amazon deforestation frontier," *Science*, June 12, 2009, Volume 324, Number 5933, pp. 1435–7 (www.sciencemag.org).
[5] These figures are based on a price of $1,100 per metric ton for crude palm oil (CPO), a fresh-fruit-bunch (FFB) average lifetime yield of 21 to 24 metric tons per hectare, and a 20 percent CPO/FFB yield.
[6] The numbers are calculated for a forest on mineral soil. For peatland forests, the carbon-stock difference with a palm-oil plantation would be significantly higher.
[7] Guyana-Norway Agreement, Joint Concept Note, March 31, 2011 (www.lcds.gov.gy).
[8] *Resource revolution: Meeting the world's energy, materials, food, and water needs*, McKinsey Global Institute and McKinsey Sustainability & Resource Productivity practice, November 2011 (www.mckinsey.com).
[9] H. K. Gibbs et al., "Tropical forests were the primary sources of new agricultural land in the 1980s and 1990s," *Proceedings of the National Academy of Sciences*, 2010, Volume 107, Number 38, 16732–7 (www.pnas.org).
[10] According to the Web site for the database, "The Voluntary REDD+ Database was formally launched at the Ministerial Meeting of the REDD+ Partnership in Nagoya, Japan, in October 2010, building on the initial data collection effort by Australia, France, and Papua New Guinea launched during the Paris-Oslo process. It aims to improve transparency around REDD+, support efforts to identify and analyse gaps and overlaps in REDD+ financing, and help share experiences on REDD+" (reddplusdatabase.org).
[11] United Nations Commodity Trade Statistics Database (comtrade.un.org).
[12] *Emergency finance for tropical forests, two years on: Is interim REDD+ finance being delivered as needed?* The Prince's Rainforests Project, October 2011 (www.pcfisu.org).
[13] The Programme for the Endorsement of Forest Certification is the world's largest forest-certification system (www.pefc.org).
[14] The Roundtable on Sustainable Palm Oil was formed in 2004 with the objective of promoting the growth and use of sustainable palm-oil products through credible global standards and engagement of stakeholders (www.rspo.org).
[15] J. N. Pretty et al., "Resource-conserving agriculture increases yields in developing countries," *Environmental Science & Technology*, 2006, Volume 40, pp. 1114–9 (www.pubs.acs.org).
[16] *Resource revolution: Meeting the world's energy, materials, food, and water needs*, McKinsey Global Institute and McKinsey Sustainability & Resource Productivity practice, November 2011 (www.mckinsey.com).
[17] Spatial planning refers to the methods used by the public sector to influence the distribution of people and activities in spaces of various scales. Discrete professional disciplines that involve spatial planning include land-use planning, urban planning, regional planning, transport planning, and environmental planning.
[18] We provide a detailed discussion of the opportunities and challenges presented by expanding agriculture into "available" land in *Resource revolution: Meeting the world's energy, materials, food, and water needs*, McKinsey Global Institute and McKinsey Sustainability & Resource Productivity practice, November 2011 (www.mckinsey.com).
[19] Outgrower programs are contract-farming arrangements whereby small farmers are linked with larger farms or operations that may support production planning, supply input, and provide services such as advice and transportation.
[20] Sunil Sanghvi, Rupert Simons, and Roberto Uchoa, "Four lessons for transforming African agriculture," *McKinsey Quarterly*, April 2011 (www.mckinseyquarterly.com).
[21] Sassan S. Saatchi et al., "Benchmark map of forest carbon stocks in tropical regions across three continents," *Proceedings of the National Academy of Sciences*, 2011, Volume 108, Number. 24, 9899–904 (www.pnas.org).
[22] A. Baccini et al., "Estimated carbon dioxide emissions from tropical deforestation improved by carbon-density maps," *Nature Climate Change*, 2012, Volume 2, pp. 182–5 (www.nature.com).
[23] Arild Angelsn et al., *Reducing emissions from deforestation and forest degradation (REDD): An options assessment report*, 2009 (www.REDD-OAR.org).
[24] Markku Simula, *Financing flows and needs to implement the non-legally binding instrument on all types of forests*, prepared for the Advisory Group on Finance of the Collaborative Partnership on Forests, with the support of the Program on Forests, World Bank, Washington, DC, 2008 (www.un.org).

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