WORLD BANK GROUP

Designing Fiscal Instruments for Sustainable Forests

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Environmental Taxation and Sustainable Forest Management

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Forest Policy Landscape

Many policy measures have been implemented to encourage sustainable management of forest resources and forest conservation (table 1.1). The main policy instruments applied in the timber sector include regulatory approaches (bans, management plans, and sustainability standards), information and voluntary instruments (disclosure requirements and sustainability certifications), and economic instruments like results-based expenditures and environmental taxation.

TABLE 1.1
SELECT POLICY INSTRUMENTS FOR ENVIRONMENTAL MANAGEMENT AND SUSTAINABLE USE OF FORESTS

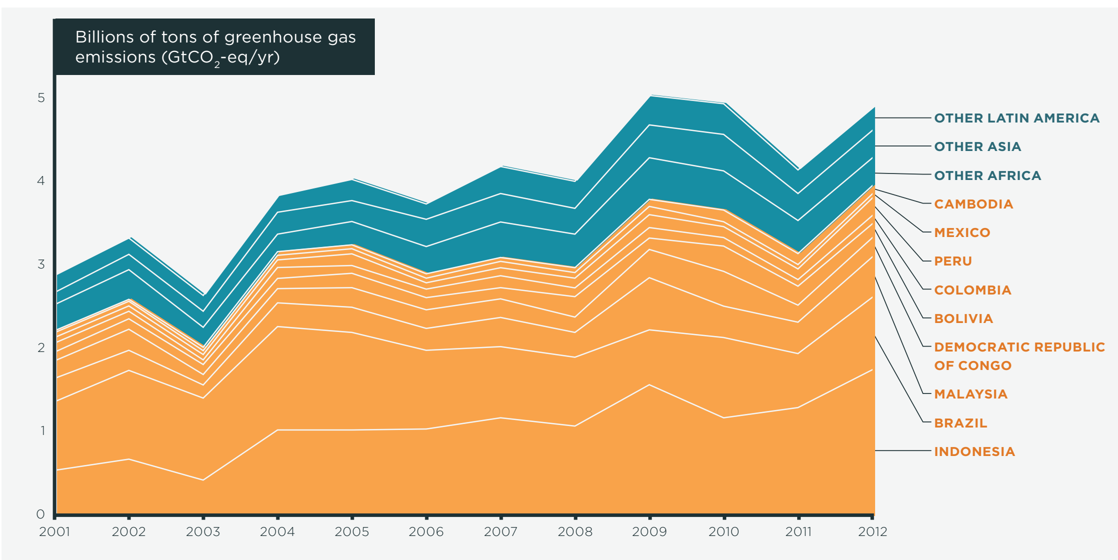
REGULATORY APPROACHES	INFORMATION & VOLUNTARY INSTRUMENTS	ECONOMIC INSTRUMENTS
▪ Restrictions or prohibitions on use (e.g., restrictions on trade in illegal timber) ▪ Restrictions or prohibitions on access and use (e.g., designation of protected area) ▪ Permits and quotas ▪ Quality, quantity, and design standards (e.g., minimum harvesting diameters) ▪ Spatial planning (e.g., ecological corridors) ▪ Planning tools and requirements (e.g., environmental impact assessments, strategic environmental assessments)	▪ Ecolabeling and certification (e.g., sustainability certification) ▪ Green public procurement ▪ Voluntary approaches (e.g., negotiated agreements between firms and governments) ▪ Corporate environmental accounting ▪ Conditional credit	▪ Results-based expenditure policy (payments for ecosystem services, REDD+) ▪ Subsidies ▪ Environmental taxation (taxes, charges and fees, e.g., royalties) ▪ Tradable permits ▪ Biodiversity offsets/biobanking ▪ Liability instruments (noncompliance fines) ▪ Performance bonds

Source: Adapted from OECD 2013.

Despite the variety of available policies, deforestation and forest degradation continue around the world. Global forest area declined from 31.6 percent to 30.6 percent between 1990 and 2015 (FAO 2018). Tropical deforestation is of particular concern as deforestation rates are much higher for this region. Overall, tropical deforestation increased by 53 percent between 2001 and 2012, from an average of 6 to 9.2 million hectares per year (Austin et al. 2017). This pace has not slowed: 2016 and 2017 set records for tropical tree cover loss (Weisse and Goldman 2018). Tropical deforestation is most extensive in Latin America and Sub-Saharan Africa, with forest area losses of 7 percent and 9 percent, respectively, between 1995 and 2014 (Lange et al. 2018).

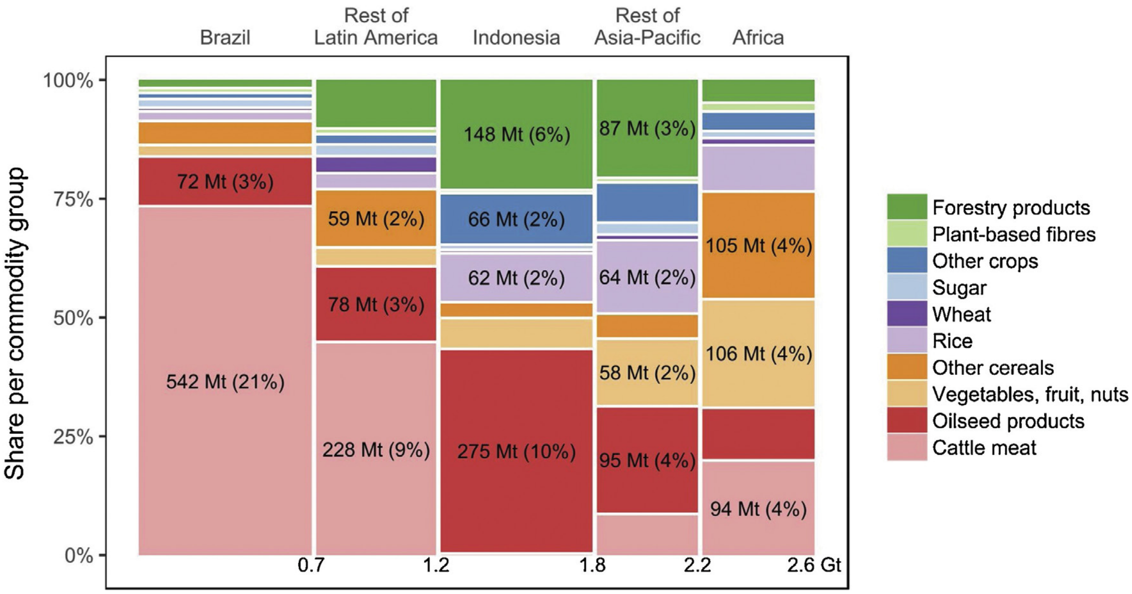
The loss of global forestland coincides with and contributes to other major depletions of environmental resource stocks. Emissions from deforestation have grown and contributed to the rising levels of overall atmospheric carbon dioxide (CO_2) concentrations (figures 1.1 and 1.2). In addition, deforestation has contributed to significant total biodiversity losses over the last several decades through habitat loss and other factors (Giam 2017) (figure 1.3). This depletion of key environmental resource stocks has important implications for environmental carrying capacities (Dryzek 2013; Keohane and Olmstead 2016; Rockstrom et al. 2009; Steffen et al. 2015; Wenpeng et al. 2018; Arrow et al. 1995).

FIGURE 1.1
ANNUAL CO_2-EQ EMISSIONS FROM TROPICAL DEFORESTATION, 2001–2012



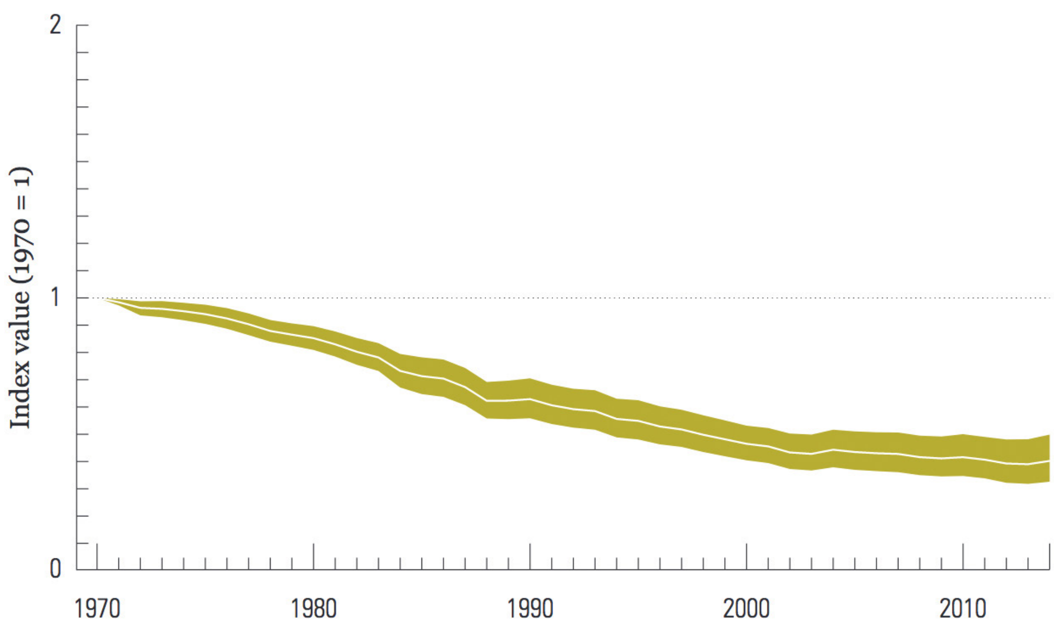
Source: Seymour and Busch 2016.
Note: The countries listed in orange represent 77 percent of the emissions from tropical deforestation.

FIGURE 1.2
CO_2-EQ EMISSIONS FROM TROPICAL DEFORESTATION BY DRIVING COMMODITY GROUP (EXCLUDING TIMBER CLEARING FOR LAND USE CHANGE), 2010–2014



Source: Pendrill et al. 2019.

FIGURE 1.3
GLOBAL BIOLOGICAL DIVERSITY INDEX, 1970–2014



Source: WWF 2018.
Note: The vertical axis represents indexed values, where 1970=1.

Deforestation, and therefore the need for policy action, is often greatest in low-income countries with low governance capacities. As such, policies are needed that are feasible and effective to implement even in low-capacity environments, especially for tropical forest-producing countries where past policy approaches have not succeeded at bringing down deforestation and forest degradation rates.

The increasing global demand for forest products exacerbates this challenge. Future demand for forest products will come from two main dimensions in addition to population growth: decarbonization trends and shifts in demand. Current trends in decarbonization indicate pressures to substitute forest-based products for carbon-intensive goods. Developing countries will also experience a shift in demand; as incomes increase, consumption patterns will likely shift to more closely match those of developed countries. By 2050, the total demand for industrial roundwood is projected to quadruple, increasing the annual supply deficit to over 4.5 billion cubic meters, compared with the current 1 billion (World Bank 2016). Low-cost and scalable policy interventions are needed to guide private investment and green growth in the forest sector to meet future demand and to stop and reverse the dramatic decay in global forests.

Environmental tax policy may have a special role to play in addressing both resource and land use management, particularly in low-income countries. Environmental taxation has so far been underutilized in the context of forest management and conservation. However, it may be particularly suited to address gaps in the climate and forest policy landscape, especially for countries under governance, budgetary, and other constraints. Environmental taxation has various benefits over the other main policy instruments for forest conservation that make it appealing in low-income countries. Environmental taxation is a low-cost option that provides dynamic incentives for sustainable forest management (SFM) and can help address funding gaps left by other policies.[1] We will now turn to each of the alternative policy approaches to forest conservation and discuss their relative advantages and disadvantages in comparison to environmental taxation.

Regulatory approaches

Regulatory policies are an important component of the forest conservation policy mix. Regulations determine minimum required standards for forest management and conservation, and—when enforced[2]—are closely correlated with decreased deforestation.[3] Such policies are key to influencing decisions made by the least sustainable or least efficient producers by, for example, restricting the most harmful practices. Key regulatory policies include protected areas and other forest reserves, environmental standards, and market bans. Bans and similar regulations do not directly change production standards but provide indirect incentives by regulating the terms under which forest products can be grown, harvested, and sold in the market. For example, the European Timber Regulation bans illegally logged timber from the EU's common market as part of the Forest Law Enforcement, Governance, and Trade (FLEGT) initiative. In some situations, these regulatory policies may be more suitable than fiscal or other market-based policies (Karsenty 2000).[4]

1 In addition to environmental tax reforms, reforms to existing fiscal regimes can help correct contradictory incentives for forest conversion while freeing up additional revenues.

2 For an in-depth discussion on forest sector regulatory policy, see World Bank (2019a) and World Bank (2019b).

3 Protected areas, in particular, are highly correlated with low deforestation rates (Busch and Ferretti-Gallon 2017).

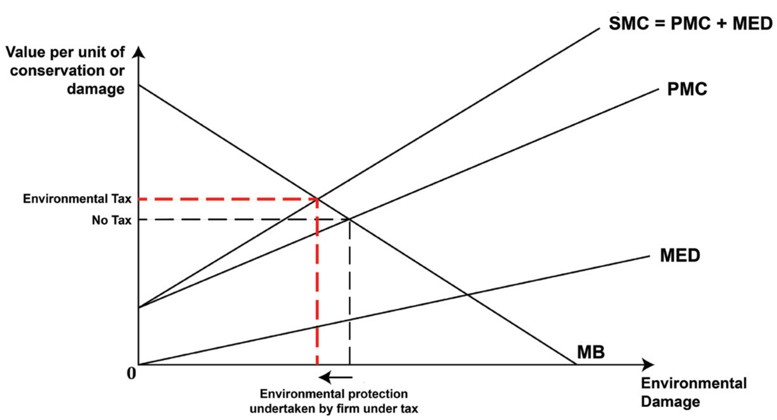
4 See chapter 4 for more details on the limitations of fiscal policy in fragile states.

Regulatory policies can be very effective at ensuring a chosen standard is met. However, they may be less cost-efficient than market-based policies. In the absence of trading markets for permits (which give firms some cost flexibility),[5] regulatory policies impose a uniform standard on all producers and are not cost-efficient if firms experience different costs for achieving the same level of sustainability (figure 1.4). In other words, if some firms can more efficiently implement sustainable practices, a regulatory policy that applies the same requirements to all firms fails to use the efficient firms' comparative advantage for driving down the overall cost of reaching a given environmental objective. The outcome is different with environmental tax policy because firms can choose to invest in sustainability investments until the costs outweigh the benefits,[6] so the marginal costs of abating environmental damages are equalized between firms instead of the total amount of abatement per firm. A recent study confirmed this by showing that fiscal mechanisms carbon taxes on land use emissions were eight times less costly compared with command-and-control policies (Souza-Rodrigues 2018).

FIGURE 1.4

COSTS OF ENVIRONMENTAL PROTECTION

A. ENVIRONMENTAL TAXES EQUALIZE MARGINAL COSTS

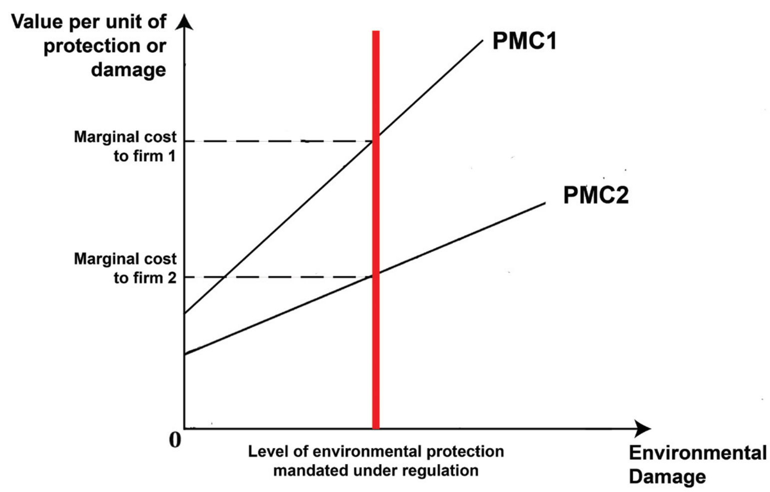


Note: Where there are negative externalities—or marginal external damages (MED)—the social marginal cost is higher than the private marginal cost. An environmental tax set equal to the MED increases the firm's private marginal cost curve to coincide with the social marginal cost curve. The quantity of output then falls to the socially optimal level of production. The environmental tax then internalizes the externality and removes the market inefficiency. MB = marginal benefit per unit of output; MED = marginal external damage per unit of output; PMC = private marginal cost per unit of output; SMC = social marginal cost per unit of output.

5 For more details on carbon markets, see "State and Trends of Carbon Pricing 2020" (World Bank 2020b), "Carbon Markets for Greenhouse Gas Emission Reduction in a Warming World" (World Bank 2018), and "Networked Carbon Markets" (World Bank 2020a).

6 Under a Pigouvian taxation framework, this point of optimal allocation is reached when the marginal mitigation costs are equal to the Pigouvian tax rate.

B. LEVEL OF MANDATED ENVIRONMENTAL PROTECTION COSTLIER COMPARED TO TAXATION



Note: Where firms have different environmental protection costs (PMC1 and PMC2), an equal reduction in environmental damage is inefficient since the marginal costs of firm 1 are higher than the marginal costs of firm 2. The optimal division of environmental damage reduction is instead where each firm's marginal cost is equal to the social marginal benefit, as in figure 1.2. PMC1 = private marginal cost curve for firm 1; PMC2 = private marginal cost curve for firm 2.

Regulatory enforcement may also be difficult in countries with low governance capabilities. The requirement that all firms conform to the same standard can be difficult to enforce,[7] especially in countries with governance constraints or corruption risks. In these cases, monitoring estimates on conservation may be unreliable and enforcement efforts insufficient (Hayes and Ostrom 2005; Nolte 2016). For example, while the FLEGT initiative has helped improve governance capacities and reduced the end-use market for illegal timber, it may not have performed as desired in terms of reducing illegal logging and related trade (EC 2016).

Information and voluntary instruments

Information instruments are another important forest management and conservation policy. Information instruments attempt to influence actors using transparency; policies include public disclosure requirements, information campaigns, audits, and certification systems. Information instruments are particularly useful in addressing decisions made in the first domain of economic decision-making (see box ES.1). Sustainability certification (or "eco-labels") may be particularly effective in promoting SFM. Certificates, like bans, modify the terms of market access, thereby providing indirect incentives for timber producers to improve their production standards.

7 In particular, it may be difficult to mandate certain behavioral responses. Additionally, dynamic incentives to encourage action above regulated standards are needed to address deforestation and forest degradation.

Sustainability certification is readily available for the timber industry. The Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC) set standards for sustainable forest products, certify forest management, and label products as "eco-friendly," often using accredited subsidiary implementing agencies. Timber certification has the potential to improve yields and quality of output, improve conditions for workers, reduce operational risk, and increase access to markets and customers.

Sustainability certification coverage is growing in the soy, palm oil, and biofuels industries, largely as a result of major international roundtables established to convene stakeholder support for shared production principles.[8] Outside of the forestry and agriculture sectors, sustainability certification is more recent but also growing for extractive industries (including gold, aluminum, and oil and gas) as well as for electronics and tourism.[9]

While certification provides critical incentives for voluntary private sector investments, it also has important limitations, which include information problems, accreditation costs, free ridership, fraud, and a limited scope for competing certification schemes (see box 6.1). Additionally, sustainability certifications are voluntary instruments, intended to improve market access and influence demand—there is no guarantee of mass adoption. While the coverage and availability of information instruments, like sustainability certifications, are increasing, they need to be further scaled up to increase their effectiveness. These limitations can be improved upon when certificates are used in combination with environmental fiscal policies.[10]

Economic instruments: Results-based expenditure policy

Results-based expenditure policies are another important mechanism to encourage forest management and conservation. These policies, which include payments for ecosystem services, are flexible and can provide incentives for private investment in SFM. Results-based expenditure policies impact the decision-making of both inefficient and optimally producing firms and individuals by modifying relative prices.[11] Such policies also directly compensate instead of regulating or taxing low-income and vulnerable populations and can improve incentives for actors to join the formal economy. These market-based expenditure policies are complementary to regulations, as land use changes and deforestation drivers are dependent on market factors (Busch and Ferretti-Gallon 2017), and generally enjoy wide support from policy makers (Wunder 2006).[12]

When carefully designed, PES can be effective at reducing both deforestation and poverty. The theoretical underpinning of PES is that actors who benefit from environmental services should pay for their provision, while those who support the provision of (or enhance) environmental services should be compensated for doing so. Additionally, PES programs can compensate for *avoided* destruction of an ecosystem service, paid to those most likely to prevent such activities.

8 For example, see the Roundtable on Sustainable Palm Oil, https://rspo.org/.

9 For example, for gold, SCS Global Services, https://www.scsglobalservices.com/services/fairmined-gold-certification; for aluminum, Aluminum Stewardship Initiative, https://aluminium-stewardship.org/about-asi/; for oil and gas, Equitable Origin, https://www.equitableorigin.org/; and for electronics, Sustainable Electronics Recycling Institute, https://sustainableelectronics.org/.

10 See chapters 6 and 7 for more details.

11 See box ES.1 for more details on how relative prices impact the decisions of firms and individuals.

12 An in-depth review of results-based expenditure policies is not included here. For more details on PES policies, see, for example, Cadman et al. (2016); Cavelier and Gray (2012); Cavelier and Gray (2014); Lee et al. (2018); Pagiola (2011); Vincent (2012); Wunder (2015); Pagiola and Platais (2002); and Pagiola et al. (2005). For more details on REDD+, see, for example, Chandrasekharan Behr et al. (2012); International Forestry Resources and Institutions Research Network (2014); Jagger (2010); and World Bank (2014).

Common ecosystem services targeted under PES programs are carbon sequestration, watershed services, biodiversity maintenance, and landscape amenity, although the latter is rarely the primary goal.[13]

PES schemes can provide strong incentives for forest smallholders, the very poor, and community-based groups to invest in sustainable land management. PES projects are generally designed to reduce poverty through their contributions to building alternative livelihoods that replace deforesting activities. By improving the economic situation of participants, either directly or through benefit-sharing arrangements, PES provide an incentive to fully commit to the program. If local users actively participate in the program, this has the added benefit of reducing the need for extensive monitoring, which reduces associated transaction costs and improves environmental outcomes (Velde 2014). Increases in income may also mean that individuals experience higher returns to labor, which reduces pressures to increase resource extraction (Anthon, Lund, and Helles 2008; Hansen and Lund 2018).

Without complementary PES schemes, landowners or users may search for solely extractive income-generating opportunities. Direct payments to landowners provide a market incentive to conserve ecosystem services or counter strong market incentives to exploit these lands. Considerable incentives for land conversion exist. For example, an increase in agricultural prices increases the incentive to convert forests to monocultural plantations or pastureland (Busch and Ferretti-Gallon 2017). Whether a PES program is sufficient to overcome these incentives for land conversion depends on many factors. Without effective PES schemes, however, landowners may not have a way otherwise to realize monetary gains from forest management and therefore face no incentives to preserve forests or enhance ecosystem services (Kroeger and Casey 2007).

REDD+ is an important international results-based expenditure policy for the forest sector. REDD+ is a policy instrument that forms part of the 2015 Paris Agreement. Developing countries receive payments for reducing emissions from forested lands and investing in low-carbon paths to green growth.[14] The REDD+ framework lays out a set of relevant practices, including the use of private carbon offset purchases and governmental transfer payments. There has been a learning process throughout the development and implementation of REDD+ and some programs have been more successful than others; one notable success was Brazil's reduction in deforestation rates until 2018 (Birdsall, Savedoff, and Seymour 2014; Boucher, Roquemore, and Fitzhugh 2013; Boucher et al. 2011; Carrington 2017; Ruiz 2017).[15]

Results-based expenditure policies using international transfers distribute and reduce the costs of forest conservation and management (Luttrell et al. 2018; Zhang et al. 2017). The environmental imperatives of climate change and resource constraints create the need for global actions that support management efforts.[16] The need to address these imperatives is complicated by the fact that SFM efforts urgently needed in developing countries may not have the necessary

13 One exception is the United Kingdom's Countryside Stewardship Scheme.

14 Both donor and offset funding mechanisms use results-based compensation; however, the use of offset credits to fund the program implies a redistribution of emissions rather than a net reduction.

15 However, the success of the program is highly dependent on both domestic and international support. Recently, the Brazilian program has been at the center of political conflict between the Brazilian president Jair Bolsonaro and major donors to the Amazon Fund (the major source of funding for REDD+ in Brazil), in particular Norway. In reaction to the Bolsonaro government's unilateral action to drastically change the rules for administering the fund combined with sharp increases in domestic deforestation rates, Norway has frozen more than $33 million in future funding for the program.

16 For developed countries with relatively secure fiscal positions, payments for conservation in other countries has the potential to supplement or fulfill requirements for Nationally Determined Contributions (Lee and Sanz 2017).

funds. International transfers between developed and developing countries help distribute conservation costs, which makes conservation efforts relatively cheaper for both those paying for and the recipients of REDD+ funding (Wara and Victor 2008). International transfer policies can also have knock-on effects by mobilizing developing countries to make additional investments in conservation (Mathiesen 2018). If all countries contribute, it is more equitable than mandates or other regulatory measures that enforce compliance on low-income nations (Nordhaus 2015; Samii et al. 2014; Trenberth 2017).

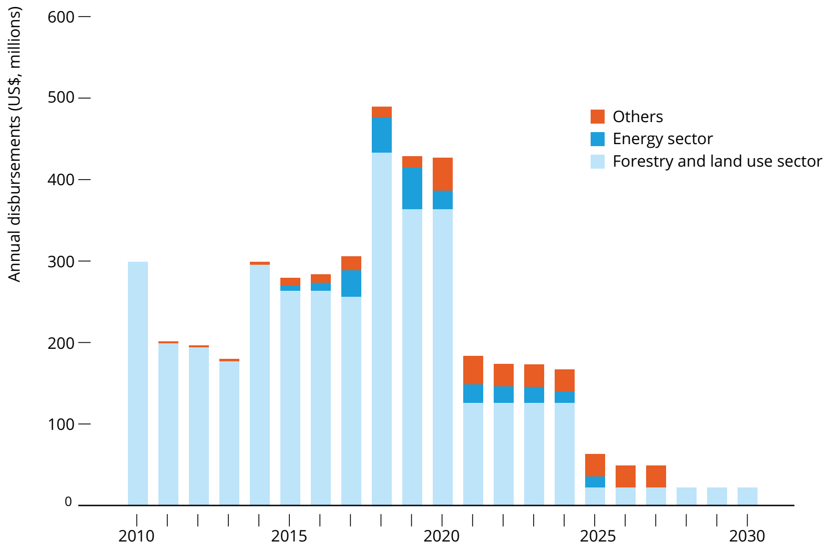
However, securing adequate and reliable funding is a major concern for results-based expenditure policies. REDD+ "will require unprecedented levels of funding" (Angelsen 2008) from developed countries. REDD+ funding must cover the opportunity and transaction costs of land users to ensure participation (Alston, Andersson, and Smith 2013; Coomes et al. 2008; Groom and Palmer 2012; Stickler et al. 2009).[17] If these costs are not covered, it can create a disincentive for smallholders and the very poor to participate; indeed, some evidence of selection bias among PES participants supports this concern (Alston, Andersson, and Smith 2013). The 12 largest programs[18] providing results-based climate finance[19] reached their estimated peak capitalization in 2015, which is expected to rapidly decline without new funding (World Bank 2017). Unless replenishment of funds can be achieved, disbursement from these programs is expected to peak between 2018 and 2020, declining thereafter (figure 1.5). The potential for funding to decline or cease is a problem for policy sustainability, as some developing countries can or will not be able to take over the needed investment (Kim 2017). Indeed, some projects have already suffered as a result of funding shortfalls (Alston, Andersson, and Smith 2013; Fletcher et al. 2016; Sunderlin et al. 2015).

17 Even if opportunity costs are covered, landowner access to credit and capital markets can impact the effectiveness of the program. The up-front costs of reforestation, timing of payouts, and up-front benefits from degradation may distort incentives to participate. For example, in the Ipeti-Embera REDD+ project in Panama, locals could allocate land to forest plantations or cattle grazing. Even though it was more profitable to reforest the land, lack of access to cash made it difficult for poor farmers to participate. The relative liquidity and lower transaction costs of cattle compared to REDD+ tree plantations made grazing initiatives more attractive than reforestation (Coomes et al. 2008). Additionally, the conditionality requirement of payments complicate payment calculations; there is a trade-off between the monitoring and enforcement costs of conditional payments and the lack of incentives provided by unconditional payments.

18 The Forest Carbon Partnership Facility (FCPF), the BioCarbon Fund Initiative for Sustainable Forest Landscapes (ISFL), the Carbon Initiative for Development (Ci-Dev), the Pilot Auction Facility (PAF), the Transformative Carbon Asset Facility (TCAF), the Carbon Partnership Facility (CPF), REDD Early Movers (REM), Norway's International Climate and Forest Initiative (NICFI), Energizing Development (EnDev), the Global Energy Transfer Feed-in Tariffs (GET FIT) Program, the N2O Initiative by the German government, and the Nordic Climate Facility (NCF).

19 Ninety percent of which is dedicated to the forestry and land use sector.

FIGURE 1.5
ESTIMATED DISBURSEMENTS FROM THE 12 LARGEST RESULTS-BASED CLIMATE FINANCE FUNDS



Source: World Bank, Ecofys, and Vivid Economics 2017.

REDD+ remains costly even if the program is funded through the sale of offsets. Some have suggested lowering the need for public expenditures by funding the program through the sale of "offsets" in emissions trading schemes (Angelsen 2006; California Air Resources Board 2015; Neeff and Ascui 2009). Similar to the former Clean Development Mechanism, forest owners in developing countries or their governments would market their emission reductions in the form of tradable certificates. In case such markets could be re-created, companies in developed countries could then buy these certificates as substitutes for complying with domestic climate change obligations.[20] On a closer look, however, REDD+ requires public funding even when offsets are used at full potential (Heine, Faure, and Lan 2017).[21] For example, if—as for the Mexican national carbon market[22]—a firm is covered by a carbon tax for its energy-related emissions and can buy a forest offset to substitute for this tax payment, the forest offset costs public revenues. **The cost is still financed by the state—now through a tax expenditure instead of a direct expenditure.** The revenue loss may be felt in another country if the forestry offset from a developing country can be used by firms in developed countries to forgo carbon tax or emissions trading system auction payments. In either case, there is a loss of public revenue that could have been raised but was forgone because of the offset. Carbon markets thus do not resolve the fundamental problem that expenditure policies for forest conservation require significant public funding.

20 Although the policy debate on "market-based REDD+" is focused on emissions trading schemes as a source of funding (Anger, Dixon, and Livengood 2012; Nimz et al. 2013; Peters-Stanley et al. 2013), these offsets could also work without emissions trading schemes, as corporations could equally be allowed to deduct their payments for overseas mitigation activities from domestic carbon taxes or from renewable portfolio standards. See Metcalf and Weisbach (2012).

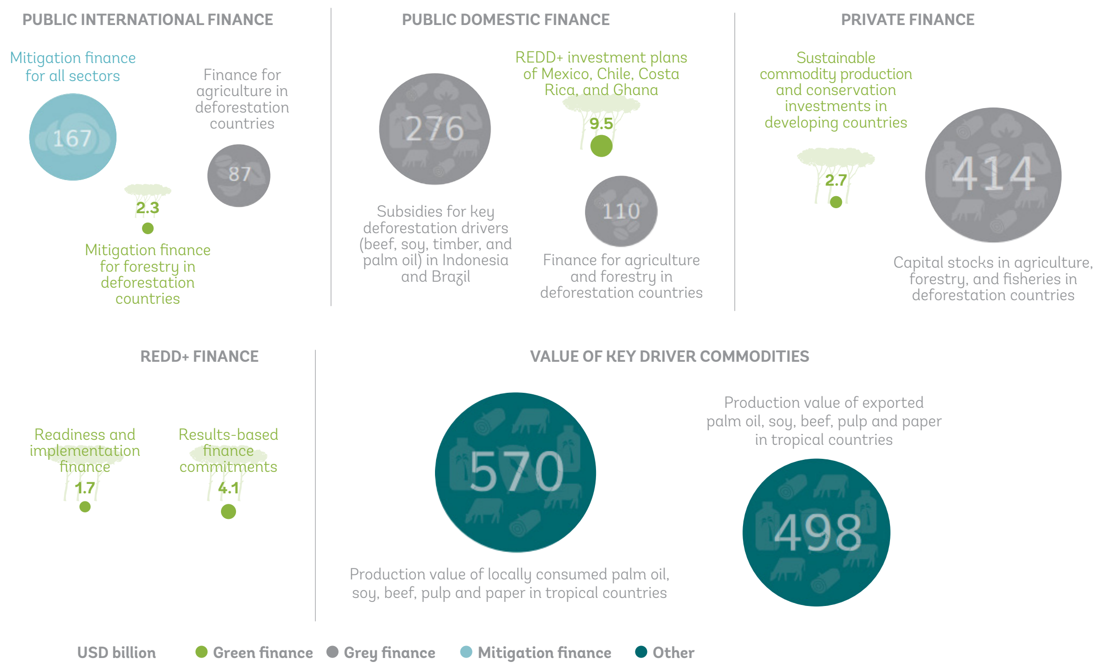
21 At present, this is not the case. Angelsen et al. (2017) argue that "a global carbon market has not materialized and is unlikely to emerge [as] the Paris agreement failed to create the binding national caps needed to boost demand for global carbon trading." However, there is recent progress in the creation of carbon markets as a result of negotiations on Paris Agreement Article 6.

22 See World Bank, Ecofys, and Vivid Economics (2017) for more details on Mexico's carbon market.

Another significant barrier to the effectiveness of results-based payment programs is the global imbalance between funding provided to such programs and that provided to deforestation drivers. Results-based payments compete with existing government policies in their influence on land use incentives. For example, REDD+ payments are competing with expenditures from the central state, like subsidies for agriculture or other deforestation-driving commodities and sectors. Domestic expenditure policies indirectly supporting deforestation outweigh the funding available through REDD+ or other projects seeking to prevent deforestation. For example, estimates from five countries show that agricultural and biofuel subsidies exceeded REDD+ finance by 600 and 9 times, respectively (McFarland, Whitley, and Kissinger 2015). As public expenditure policies reward land conversions, it can be difficult to enroll stakeholders in conservation-related expenditure programs (Dobbs and Pretty 2008).

This imbalance is also reflected in international climate and development finance flows. For example, in countries with high deforestation, forest conservation-related finance accounts for only 1 percent of global climate change mitigation development funding (Climate Focus 2017).[23] In total, the $20 billion that has been provided to support forest-based mitigation programs is trivial compared with the $777 billion in "gray finance" that has been provided to support land use sectors without clear alignment with forest and climate goals (figure 1.6). Furthermore, the forestry sector itself is under-funded; the amount of private sector investment falls short of that needed both to meet international demand and to fund SFM (figure 1.7). Environmental fiscal policy, both through reforms of existing fiscal regimes and through environmental taxation mechanisms, can help address these imbalances and channel investment toward SFM.

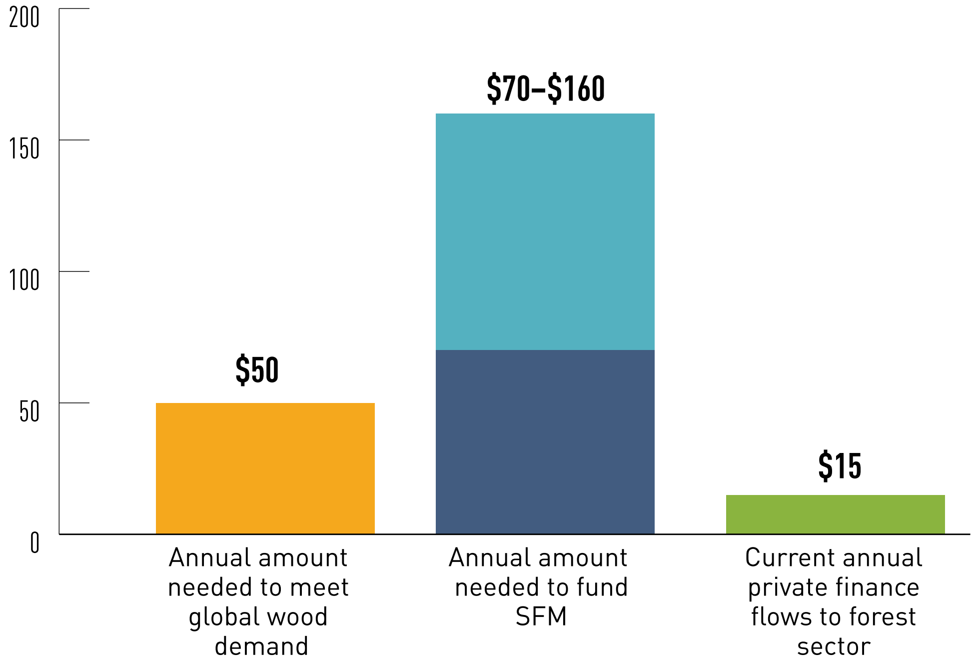
FIGURE 1.6
TOTAL GREEN AND GRAY FINANCE FLOWS, SINCE 2010



Source: Climate Focus 2017.

23 This figure is starker when one considers that forests represent up to 30 percent of the mitigation required to meet the goals under the Paris Agreement.

FIGURE 1.7
FUNDING GAPS IN THE FOREST SECTOR (US$, BILLIONS)



Source: World Bank 2016.
Note: SFM = sustainable forest management.

ENVIRONMENTAL TAXATION

STEFAN SPECK

Fundamentals of environmental taxation

Environmental taxation tackles one "market failure" by internalizing external costs. Markets provide the most economically efficient means of allocating scarce resources. However, this allocation is not always a fair one as markets can also be subject to failures, like the fact that external costs and benefits are not reflected in prices of goods and services. This market failure provides the rationale for governmental intervention and relies on the "polluter-pays" principle as an economic principle for allocating the costs of environmental damage control so that "a polluter has to bear all the costs of preventing and controlling pollution that [they] originate" (OECD 1992).[24] Government can intervene by creating new markets, such as for tradable emission permits, or by building on existing structures to correct market failures by using environmental taxes.

The main role of environmental tax policy is to influence marginal incentives by sending price signals.[25] By incorporating the environmental costs of productive activity, market prices will reflect their true costs and firms can make better-informed decisions about SFM investments. Environmental tax policy can also affect the incentives of government; implementing an environmental tax raises the profile and attention paid to SFM so the government might sustain future revenues (World Bank 2005).

24 For more details on the polluter-pays principle, Coasian bargaining, and Pigouvian taxes, see Heine et al. (2020).
25 See Hanson and Sandalow (2006); GTZ (2005); Parry et al. (2014); and Parry et al. (2012).

Environmental taxes can be designed to achieve quantity policy targets. The prevailing economic concept of designing environmental taxes is based on Pigou's (1920) seminal work of setting the tax rate equal to the marginal external damage, thereby controlling an unregulated free market by integrating the external costs into the price. However, the calculation of the marginal external damage is quite complicated in practice as the value of damages can vary significantly across the landscape (see box 1.1 for the Amazon case), though it is feasible to set the tax rate close to the optimal level. A more pragmatic approach is to set the tax rate at a level that is estimated to be sufficient to achieve a given environmental target. This is known in economic literature as the "standard-price approach" (Baumol and Oates 1971). It is a good solution in environmental policy areas for which quantifiable reduction targets are more established than the shadow prices for valuing an externality. For example, Coady, Parry, and Shang (2018) state that "concerning the valuation of carbon damages, the standard approach in the economics literature has been to use the social cost of carbon (SCC).... However, countries may instead prefer to use CO_2 values that are in line with their mitigation pledges under the 2015 Paris Agreement, which can differ substantially from the SCC."

BOX 1.1 VALUING ECONOMIC LOSSES RESULTING FROM AMAZON FOREST LOSSES

JON STRAND

Changes in the Amazon rain forest cover are associated with a wide range of impacts, locally, regionally, and globally.[a] A rational land use policy for the Amazon region dictates that deforestation not take place as long as the total economic value of the protected forest, properly defined and measured, exceeds the value of deforested land in its best alternative use (such as for agriculture or urban development). The opportunity values—for example, in timber or agricultural values of converted forest—are relatively easy to observe, and private parties have high incentives to exploit them. The protection values are more difficult to both observe and measure.[b]

A useful concept of rain forest value is the loss to the region when a small section is lost, corresponding to the *marginal value* of the rain forest. *Negative* externalities can occur when losing a small forest area induces further losses due to fragmentation (increasing forest fire risks) and increased forest dryness. These knock-on effects increase marginal forest values because losing a small part of the forest also imposes losses on the remaining forest. Positive externalities can occur when endemic or otherwise threatened species migrate from deforested to remaining forest areas, or when tourism and recreation activity moves similarly. Such effects reduce marginal values. A marginal valuation approach, while theoretically appropriate, is highly demanding in terms of data needs. For practical purposes, the figures described below largely reflect average values.[c]

HYDROLOGICAL IMPACTS OF AMAZON DEFORESTATION

Amazon deforestation leads to changes in the amounts and variability of rainfall, both within and outside of the Amazon. Such impacts can be felt for economic activities including agriculture, river navigation, public water supply, and hydropower production.[d] The maximum impacts of these rainfall changes on soy-growing areas exceed \$200/ha/year; the average loss impact calculations indicate losses up to only about \$10 ha^{-1} $year^{-1}$ of lost Amazon forest, with similar figures for beef.

REDUCED-IMPACT LOGGING

The marginal value from reduced-impact logging (RIL)[e] could be low in most of the region, for two main reasons. First, a large part of the Amazon is now either protected or administered as indigenous zones, and commercial timber extraction is not permitted in these areas. Second, extraction costs are high for much of the remaining forest area, in particular in the western Amazon where roads are virtually nonexistent.[f] Net values can, in smaller selected areas, reach up to \$320/ha/year but are mostly less than \$20/ha/year.

MAPPING OF FOREST FIRE ACTIVITY IN THE AMAZON

Forest fire activity has two contradictory value impacts. Forest fires *reduce average forest values* as burnt forest is lost or has a lower market value. Forest fire occurrence, conversely, tends to *increase marginal forest values* in many parts of the Amazon. Forest fires are more prevalent in remaining parts of the forest that have been fragmented by fire or logging, leading to externality effects whereby initial forest losses increase fire frequency and severity, consuming more of the forest, serving as a multiplier on the initial loss. This factor has implications for the value of preventing deforestation, which is magnified by reductions in forest fire risk. Impacts on (average) values for standing forests as a result of forest fires are relatively modest; they are highest in the southernmost and southeastern Amazon but exceed \$1 ha^{-1} $year^{-1}$ only in small parts of the region (and go up to a maximum of around \$5 ha^{-1} $year^{-1}$).

BIOLOGICAL RESOURCES INCLUDING BIODIVERSITY

The Amazon's biological resource base has various values and aspects that render its economic valuation a challenge. One set of such values is the direct (actual and potential) tangible values through services rendered such as pollination and through bioprospecting (the possibility of commercial utilization of the relevant biological resources, for instance, through new pharmaceutical products). But the biological resource base of the Amazon has nonuse (existence and preservation) values to all of humanity, including for the populations of the region for generations to come. Since there are generally no markets for most of these resources, their values depend largely on subjective preferences by the present generation of humans, and values ascribed by these to future generations. A further challenge is to distinguish fruitfully between "marginal" and "average" biodiversity impacts and values. One issue here is that the number of species extinctions that will follow from moderate deforestation of the Amazon (say, 10–20 percent) could be limited, while species losses from total deforestation would likely be very large (possibly, in the million range or more).[g]

a. Strand et al. (2018) provide more details.
b. Strand et al. (2018) have measured some of these values with relatively high integrity and precision but captured far from all forest ecosystem values.
c. Many potential value elements, including bioprospecting, tourism, nutrient retention, and protection against flooding and droughts, which are important for the overall value of the Amazon and play a large role in much of the related literature, are not included because of our inability (at this time) to map their economic values in a solid and meaningful way.
d. The model calculations of rainfall impact from Amazon deforestation alternatives are highly uncertain and more uncertain for larger assumed future forest losses. While in most parts of the region rainfall will be reduced in response to deforestation, in some smaller parts of the region the prediction is even *increased* rainfall.
e. RIL implies a delicate balance between timber extraction and quality of remaining forest in the Amazon. Extracting all high-value timber may be economically attractive in the short run, but it could reduce the value of the remaining forest, including its biodiversity, in the longer run.
f. The highest net values are found in areas west of Belém and in certain selected areas in western Amazonia with good road or flotation access.
g. See *The Economist* (2013) special report on biodiversity.

The efficiency objective of environmental taxation consists of providing the right incentives to market participants to consider the costs that their actions impose on third parties.[26] For example, a forester harvesting trees causes the release of greenhouse gases, which cause global damages, reduce soil fertility, increase sedimentation in waterways that impose a harm on people in the vicinity, and so on. By incorporating these costs into the price of timber, an environmental tax reform gives the forester the incentive to cause environmental damage only when his personal gain exceeds the cost imposed to society.

26 See Pigato (2019) for more details on the efficiency and effectiveness objectives of environmental taxation.

The effectiveness objective of environmental taxation consists of reducing the environmental damage in physical terms. In most situations, there is no conflict between the efficiency objective and the objective to minimize environmental damages. Well-designed environmental taxation simultaneously provides the incentives to internalize costs that market participants impose on others and achieves significant reduction in those damages (see, for example, Li, Linn, and Muehlegger 2014; Miller and Vela 2013; Mukherjee and Chakraborty 2015).

Environmental taxation, unlike many other policies, can also generate revenue. While some of this revenue will go toward the implementation costs of the new policy, the remainder could be used for various purposes. For example, governments can use tax revenue toward expenditures that enhance forest sustainability, to compensate impacted groups, or toward a reduction in other taxes.

Environmental taxation may, however, be better suited to address particular resources. Environmental taxation can be used where the sustainability of the resource or the environmental impact from industry activities is not reflected in current prices. Environmental taxation can also be used to reduce dependency on specific resources, including those "with high economic importance or increasing demand, import dependency, geological scarcity or geopolitical risk of supply" (Eckermann et al. 2015).

Environmental tax policy is appropriate in the following circumstances:

a. Where environmental degradation is caused by many different sources
b. Where mitigation costs differ significantly among actors
c. Where there is not just one technological fix for a government to mandate
d. Where environmental damages or the products associated with environmental damages are relatively easy to measure and monitor[27]

While these conditions might not be perfectly met in all situations, diversions can be taken into consideration and fiscal policy can be adjusted accordingly. For example, the measurement of damages can be quite costly and much technical capacity would be needed to identify all sources of environmental degradation. Instead, calculations based on an average marginal external damage or the standard-price approach can be used as an estimate and need only be revised periodically. Furthermore, costly monitoring could be alleviated using third-party monitoring or certification agencies, as recommended in chapter 6.

27 Adapted from Hanson and Sandalow (2006).

Role for environmental taxation in the forest policy landscape

Environmental fiscal policy can fill gaps left by other policies. Insufficiencies in both regulatory and results-based expenditure policies create the need for supplementary price-based instruments with lower costs or potential contributions toward domestic resource mobilization. In regulatory policy, these gaps are largely to do with marginal incentives and enforcement capacities, while expenditure policies fall short mainly because of their funding needs, ability to meet future demand, and global imbalances in support provided for forests versus deforestation drivers.

Revenue-neutral or revenue-raising environmental fiscal policy mechanisms can fill these gaps in certain situations. Environmental tax policy can create a system of domestic incentives that promote growth and formalization of the industry, thereby channeling private investment toward sustainable production practices and helping to overcome limited public sector and international donor funding.[28] Reforming existing fiscal regimes can help address the imbalance between funding provided for forest conservation and for deforestation-driving sectors and commodities.

Environmental taxation is generally the most growth-friendly policy instrument for reducing environmental damages, particularly in countries with limited administrative capacity.[29] The typical alternative to environmental taxation has been regulations such as prohibitions against damaging activities or rules mandating the adoption of certain technologies. Instead of the "red tape" approach, environmental taxation is an incentive-based instrument; rather than prohibiting an activity, its external costs are incorporated into the price. A uniform price for environmental damage equates abatement costs across firms, households, and sectors (Parry et al. 2012). This approach enables environmentally damaging businesses to continue their activity if it is economically efficient to do so, in the sense that the private gain from continuing the activity (that is, producer and consumer marginal surplus) exceeds the social cost of the activity (in other words, the tax rate). In this way, environmental taxation reduces economic activities that cause more harm than benefit. A profit-maximizing firm will reduce its environmental damage to the level at which its private marginal cost for achieving these damage reductions equals the environmental tax. Through this private optimization, environmental damage continues when the continuation of the activities increases overall economic value in society at large—and ceases otherwise.

Another cost advantage of environmental taxation over regulatory policy is the scope of environmental damage reduction opportunities.[30] For example, an environmental forestry tax can provide firms with an incentive to switch to more efficient production techniques. Firms can then choose which techniques are most cost-effective, allowing for a wide range of possibilities. The damage reductions occur where they are least expensive, minimizing economy-wide costs (Ackerman and Stewart 1985; Buchanan and Tullock 1975). Environmental taxes can provide firms with an incentive to source more sustainable inputs (input substitution effect) and reduce degradation (abatement effect) while simultaneously providing an incentive to consumers to purchase goods with lower associated environmental damages.[31] By contrast, a regulation mandating that foresters adopt a specific production method (for instance, RIL) uses a much

28 See Kim (2017) for more details.

29 See Chiroleu-Assouline and Fodha (2011); Fullerton (2001); Goulder et al. (1999); Kaplow and Shavell (2002); Krupnick et al. (2010); Sterner and Coria (2013).

30 For example, Aldy et al. (2010) and Krupnick et al. (2010).

31 Output substitution effect; for example, Sterner and Coria (2013).

narrower set of options for reducing environmental impacts. In this case, some of the cost advantages of firms with cheaper damage mitigation opportunities than their competitors remain unused, and the overall environmental target is reached at greater cost.

These cost advantages tend to hold over time. A regulatory standard would require forest operators to adopt a certain production technique or processing efficiency. After achieving this mandate, there is no incentive for the logging firm to continue improving SFM. However, with environmental taxation, firms face dynamic incentives to continue reducing costs (Sterner and Coria 2013).

Environmental fiscal policies may also help improve regulatory enforcement. While such policies will not directly improve enforcement capabilities themselves, they can help reinforce compliance by aligning fiscal incentives with environmental objectives. Environmental tax policy creates additional incentives to comply with and even go beyond regulatory standards. Where enforcement issues stem from contradictory incentives faced by public actors, environmental fiscal reforms (such as ecological fiscal transfers) may also help improve regulatory enforcement.[32]

Environmental taxation may also be lower-cost than results-based expenditure policies. Environmental taxation, including the introduction of new mechanisms and the reform of existing regimes, can be done at low cost by reusing existing systems. Environmental considerations can easily be built into existing fiscal incentive structures. Compared with policies like REDD+, environmental taxation substantially decreases funding requirements. In some cases, environmental fiscal policies may even contribute to domestic resource mobilization. In other cases, environmental fiscal policies are best combined with a particular type of temporary results-based expenditure policies: policy crediting, that is, to reward a country for environmental improvements that are directly attributable to the adoption of the fiscal policy.

BOX 1.2 GLOBAL EXTERNALITIES FROM FOREST ECOSYSTEM SERVICES

Benefits from forest protection are shared across countries, justifying an interest of countries in protecting forests outside their borders. Also, countries that do not have significant forests themselves have an interest in supporting the protection of global forests because the benefits of these forests are globally shared. Global forest services can be classified as *resources* (industrial wood, fuelwood, non-wood forest products), *amenities* (spiritual, cultural, historical), *biospheric reservoirs* (biodiversity, climate stabilization), *social* (sports fishing/hunting, recreation, ecotourism) and *ecological services* (water, health and soil protection) (Shvidenko et al. 2005). As a result of these nonmarket services, "forest degradation through over-exploitation generally implies an economic cost far beyond the loss of timber production potential" (Leruth, Paris, and Ruzicka 2001). Part of these forest services are global externalities that accrue to countries other than those hosting the forest, thereby justifying a sharing of costs for the maintenance of the forests. Here we list the two most important sources of these external benefits.

CLIMATE

Globally, forest biomass stores over 1 trillion tonnes of CO_2 (Nabuurs et al. 2007), so there is a large stock even compared to the current total flow of greenhouse gas emissions of about 40 billion tonnes of CO_2 annually (IPCC 2014). All countries have an interest in avoiding the release of this stock of carbon into the atmosphere, which is happening at a rate of 6 billion tonnes per year (Mendelsohn et al. 2012).

Besides forests as sources of emissions, their cross-border importance arises from their role as emission sinks. Forests sequester one-quarter of anthropogenic carbon emissions and

32 See chapter 11 for more details on ecological fiscal transfers.

do so much more cheaply than other mitigation technologies (Eliasch Review 2008; Golub et al. 2009; Kartha and Dooley 2015; Nabuurs et al. 2007; Rose et al. 2012; Stern 2006).

BIODIVERSITY

Forests are the world's largest repository of terrestrial biodiversity; tropical rain forests account for between 50 percent and 90 percent of land species (CBD 2010; WRI 1992). Contingent valuation studies suggest that these species have large intrinsic and nonuse values to humans in general (OECD 2001), including in developed countries for faraway forests (Navrud and Strand 2013). Besides these nonpecuniary externalities, all countries share in the consumer benefit from commercial uses of forests, which include biotechnology (Alho 2008). For example, 25–50 percent of new medical products and pharmaceuticals are derived from genetic resources that are largely dependent on biodiversity (Barthlott et al. 2005).

Environmental fiscal policy can be implemented unilaterally, which results in more control by individual states over their domestic policies. This is true especially when environmental fiscal policy is compared with international results-based expenditure policies such as REDD+, which are exposed to the variability of international politics and allow for less control by sovereign recipient states. The existence of positive global externalities provided by forests (box 1.2) justifies international financing to compensate low-income countries for protecting these resources. However, developing countries do not need to wait for such funding to become available to implement domestic forest conservation and management policy; indeed, there are many rationales for forest-producing countries to act unilaterally through domestic environmental fiscal policy (for example, see box 1.3).

BOX 1.3 POPULAR SUPPORT FOR FINANCING INTERNATIONAL AND DOMESTIC FOREST CONSERVATION POLICIES

JON STRAND

Both in developed and in developing countries, political debates recur if the public attributes high-enough values to tropical forests in developing countries to justify forest conservation.[a] For politicians in developed countries, it is important to know if their electorate values overseas forests like the Amazon strongly enough to justify the provision of international financing such as REDD+. And if this international funding remains limited, it is important to know for politicians in developing countries if their electorate values their domestic forests enough to justify bridging the gap in international support with national domestic policy action. The empirical economic literature on the willingness to pay (WTP) for forest protection provides answers by estimating the value that laypersons or experts ascribe to international forest protection.

The value prescribed to rain forest protection may be proportional to GDP. According to recent valuation surveys that examined the WTP to support Amazon rain forest protection in North America, Norway, and Brazil, the average national valuation per household was close to proportional to countries' average (PPP-adjusted) GDP per capita (Strand et al. 2018). The results are given in table B1.3.1.

TABLE B1.3.1
TOTAL AND PER HECTARE VALUES ASSIGNED TO BIODIVERSITY PROTECTION IN THE AMAZON (IN PPP US$)

SURVEY	ANNUAL VALUE PER HECTARE OF AMAZON RAIN FOREST PROTECTED	ANNUAL VALUE PER HECTARE OF AMAZON RAIN FOREST ASSIGNED TO BIODIVERSITY PROTECTION	TOTAL VALUATION PER YEAR OF PROGRAM TO PROTECT 10% OF AMAZON BIODIVERSITY
U.S./Canada (SP survey)	$92	$86	$5.2 billion
Delphi survey of experts (NA experts only)	$70–$100	$42	$2.5 billion
Brazil (SP survey)	$120	$18	$1.1 billion

Source: Strand et al. 2018.
Note: NA = North America; SP = stated preference.

Some countries may value *biodiversity* protection differently. A significant difference between the Brazilian figures and those from North America and Norway is that while the latter samples' values of protecting 10 percent of the *biodiversity* in the Amazon was about 40 percent of the total protection value for the entire program (about $37), this share in Brazil was only 15 percent (about $18 on a PPP basis; $10 on a nominal basis). Thus, while the population in North America is willing to pay $5.2 billion ($37 times 140 million households) annually to eliminate a "high risk of extinction" among 10 percent of the Amazon's species up to 2050, the population of Brazil is willing to pay $1.1 billion ($18 times 60 million) for the same program. The latter is smaller but still considerable. Per capita WTP to protect Amazon biodiversity among Brazilians is then found to be about 37 percent of per capita WTP in North America (on a PPP-adjusted basis; 23 percent on a nominal basis). This share is not much lower than Brazil's per capita GDP relative to that of the United States, which is 43 percent (on a PPP-adjusted basis; 27 percent on a nominal basis).

These are lower-bound estimates because they only quantify part of the benefits provided by forests. The results reflect only a fraction of the total global values related to protecting the Amazon rain forest against probable or possible forest losses over the next half-century. The social value of the forests may significantly exceed their perception in stated valuation surveys (see box 1.1). Many ecosystem values are not accounted for, and more research on WTP from additional regions is needed as well.[b] Foresighted policy makers should then take additional values into consideration, even though stated values are informative for political support of conservation actions.

The reported valuations nevertheless show that in both developed and developing countries, populations do value the protection of tropical forests, which justifies governments in both to finance forest conservation. For developed countries, international financing of overseas conservation efforts like REDD+ are justified by the populace's stated willingness to pay. For developing countries, the WTP of their own populace justifies that countries should put in place domestic conservation policies even in cases where those have to be domestically funded. The finding of a domestic WTP for policies in developing countries is essential for this publication, which is focused on domestic policy action that can be implemented even when external funding is not forthcoming. Not only is it possible to act through domestic fiscal policy, as shown in the rest of this volume, but such action is also politically justified—even when it costs. Failing to act would destroy value also to the domestic population.

The results also show that in poorer countries, more international financing and/or cheaper conservation policies are needed. The relation between GDP and the willingness to pay for conservation justifies preferential access to international financing for poorer countries. It also justifies that domestic policies for forest protection in developing countries should be of the cheapest possible type, such as fiscal policies that may even raise funding like forest taxes.

a. More details provided in Strand et al. (2018).
b. Some of these are already valued in spatial detail for the Brazilian Amazon by Strand et al. (2018).

Environmental fiscal policy is well suited to foster the industry investment necessary to meet future demand for forest products. Environmental tax policy can channel private investment toward more sustainable pathways. Not only will this help meet and tame the dramatically growing demand for forest products while avoiding excessive environmental damages, but it will also situate forest-producing countries to meet the levels of sustainable production increasingly demanded by international consumer markets. Compared with results-based expenditure programs for abstaining from forest exploitation that can restrict the supply of forest products, environmental taxation supports private investment in SFM and green industry growth. Results-based expenditure programs also may be better suited to target smallholders or subsistence farmers,[33] whereas an environmental tax can better target commercial producers. When environmental tax policy is used in conjunction with information instruments, it can target both the supply of and demand for forest products.[34]

Environmental fiscal policy can also address the large imbalances between funding provided to forests and that provided to deforestation-driving sectors and commodities. Reforms to existing fiscal regimes, including subsidy and other incentive reforms, budget tagging, and ecological fiscal transfers, can help reduce funding provided to deforestation drivers. If funding can be better balanced, it will reduce contradictory incentives for forestland conversion. In addition, these reforms can be designed to be revenue neutral or even revenue raising.

Despite these advantages, environmental fiscal policy in forestry has lagged other sectors. For example, environmental taxation is much more widespread for fuels for several reasons, often related to access of information. The calculation of the emissions and other environmental damages from fuels is much more straightforward and easier to tax (Parry et al. 2014) than those from forestry activities and deforestation, which can significantly vary across landscapes. Furthermore, the high levels of informality that characterize the forest sector present specific problems—like information access—which do not exist for highly regulated commodities like fuels (see chapter 2 for more details). However, these constraints to using environmental taxation in the forest sector can be overcome through careful instrument design (see chapter 3 for more details) and new policy combinations (see chapters 5, 6, and 7 for more details).

33 Environmental taxation may be less appropriate in these cases because of the distributional issues of taxing vulnerable populations as well as because of the risk that these actors will enter informal markets in response to higher costs.

34 See chapters 6 and 7 for more details.

Environmental Taxation in the Forest Sector

Environmental taxation for the forestry sector can help reduce the incentives for deforestation and forest degradation. Environmental tax policies for the forest sector include both reforms to existing fiscal regimes and subsidies as well as new mechanisms and policy combinations.

Reforming the fiscal framework for the forest sector can reduce competitive advantages between land uses. Current fiscal regimes may be "blind" to how they impact the incentives for different land uses. Fiscal incentives can be heavily biased toward agricultural or other commodities. Reforming such policies may reduce the incentive to convert forestland to other uses. For example, in Brazil the fiscal system was changed in the 1990s and forests were classified as a "productive land use" and were thereby given an exemption from the Rural Property Tax. This reform reduced the incentive for farmers to remove trees from their land because they no longer needed to pay higher land taxes on these plots.[35] However, Brazilian land taxes still provide an incentive for land clearing: The tax rate decreases as greater portions of the property in question are used for agriculture, encouraging landowners to convert forested land to agricultural use.[36] A reduction of subsidies to other land use sectors combined with other fiscal policy reforms may "level the playing field" by reducing the opportunity costs of maintaining forest stands.[37]

Traditional timber sector taxes can also be adjusted or reformed to optimize the incentives sent to private actors.[38] Traditional sectoral taxes include excise taxes, royalty charges including area fees, corporate income taxes, and export taxes, among others.[39] Forestry taxation can make up a significant portion of government revenues (including export earnings) in a variety of countries (table 1.3). If environmental taxation were implemented, it could be a significant new source of revenue in some countries.

35 See box 3.1 for a discussion of the impact of land taxation on land conversion.
36 Furthermore, many properties have less than the legal minimum level of forest cover, which suggests that the problems are much deeper than just a poorly designed property tax.
37 See chapter 12 for more details on fiscal reforms for the agriculture sector and chapters 13 and 14 for more details on fiscal reforms for nonrenewable extractive industry to reduce deforestation associated with these sectors.
38 See chapters 3 through 7 for more details.
39 Discussed in more detail in chapters 3 and 4.

TABLE 1.3
FOREST-RELATED EXPORT EARNINGS AND GOVERNMENT REVENUE FOR SELECT FOREST-PRODUCING COUNTRIES

	BENIN	CENTRAL AFRICAN REPUBLIC	CONGO, DEM. REP.	CONGO, REP.	MALI	MALAYSIA	ECUADOR	NICARAGUA
% OF EXPORT EARNINGS	0.2	48.7	0.4	11	25	4.2	0.83	
FOREST-RELATED GOVT. REVENUE (% OF TOTAL GOVT. REVENUE)	0.03	9	0.4	0.9	0.7	1.54	0.0003	0.13

Source: GTZ 2005.
Note: Benin: export 2002, revenue 2000; Central African Republic: export 2003, revenue 2003; Congo, Dem. Rep.: export 2002, revenue 2002; Congo, Rep.: export 2003, revenue 2002; Mali: export no year given, revenue 1999/2000; Malaysia: export 2002, revenue 2002; Ecuador: export 2002, revenue 2004 (est.); and Nicaragua: revenue 2003.

Furthermore, new environmental tax and fiscal policy combinations can also be implemented. For example, for countries struggling with deforestation related to internationally traded goods, implementing environmental taxation through export taxes is one option that is relatively easy to implement even in countries with low governance capacities. Other revenue-neutral and revenue-raising environmental fiscal instruments that are relatively simple to implement even under various constraints include fee-and-rebate (feebate) mechanisms and ecological fiscal transfers, along with reducing subsidies in other land use sectors that might be encouraging deforestation.

The effectiveness of forest taxes depends on the ability of administrators to target the right tax base. A tax on timber products effectively penalizes timber output. The amount of timber produced can have relatively high or low associated damage to the forest in question, depending on the type of production process used. Environmental forestry taxes should, therefore, ideally target the production methods themselves, instead of timber output, to influence incentives to invest in SFM. The effectiveness of a given policy will also depend on a functional governance system including the tax administration's capacity for developing a coherent overall tax policy[40] to achieve the Sustainable Development Goals, the objectives of the Paris Agreement, and other national objectives.

Environmental taxes in practice

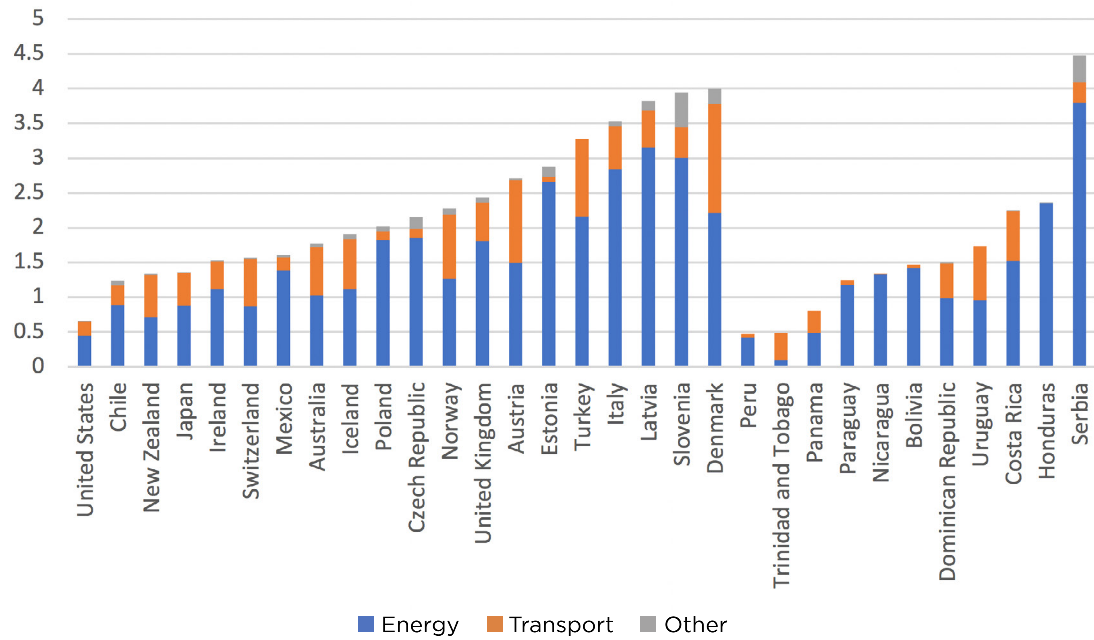
Environmental taxes have been used by some nations as a significant source of government revenue. Beginning in the 1990s, there was a push from Nordic countries to "green" their tax code (Parry et al. 2012; Speck et al. 2006). From there, environmental fiscal reform spread to Western Europe and then to emerging and developing economies (Speck and Gee 2011). In typical OECD countries, environmentally justified taxes make up 3–10 percent of total tax revenues (figure 1.8), and there is ample room to scale this up. Among OECD countries, environmental tax revenues grew between 1994 and 2016 (from $423.3 to $742.5 billion, with a peak of $795.4 billion in 2014)

40 Including investing in institutional improvements relating to the supervision, implementation, and governance of forest taxation schemes.

but declined slightly as a share of tax revenues (6.2 percent to 5.2 percent) and GDP (1.9 percent to 1.6 percent; figure 1.9).

FIGURE 1.8

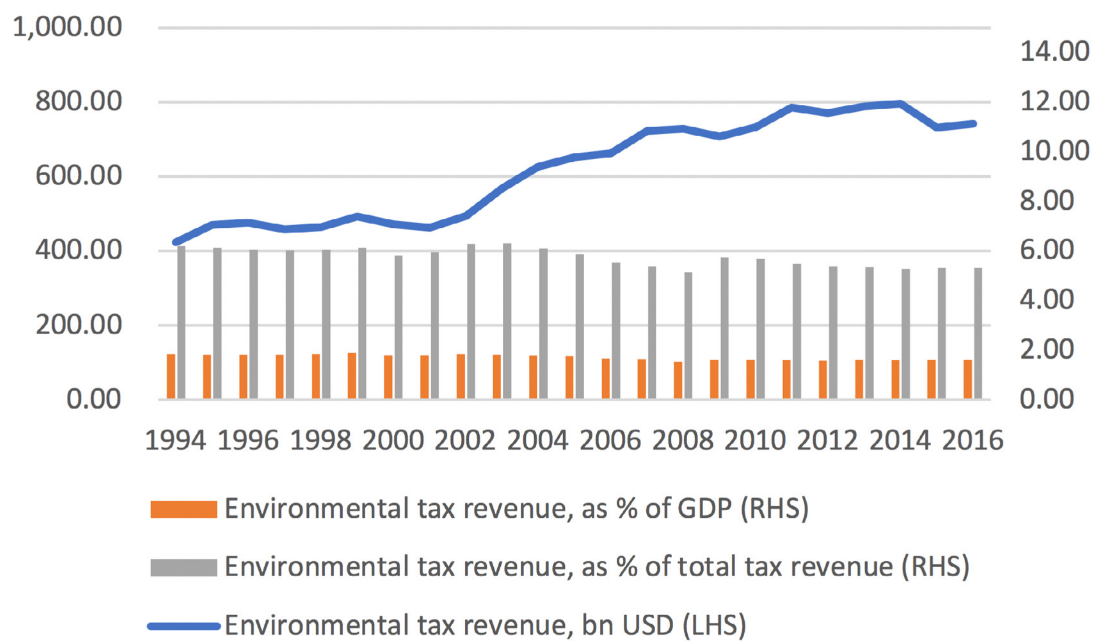
REVENUES FROM ENVIRONMENTALLY RELATED TAXES (% OF GDP), 2016



Source: OECD.stats (database), OECD, Paris, https://stats.oecd.org/Index.aspx?DataSetCode=ENV_ENVPOLICY.

The share of environmental damage and resource taxes in total environmental tax revenues is rather negligible to date since environmental taxation so far has focused on the energy and transport sectors (figure 1.8). However, given the land use and forestry sector's contribution to global GHG emissions, environmental taxation of the sector could contribute significantly to domestic resource mobilization and climate change mitigation.

FIGURE 1.9
ENVIRONMENTAL TAX REVENUES IN OECD COUNTRIES, 1994–2016



Source: OECD.stats (database), OECD, Paris, https://stats.oecd.org/Index.aspx?DataSetCode=ENV_ENVPOLICY.
Note: The line (left axis) shows gross tax revenue in OECD countries increased 1994–2014, but the bars (right axis) show revenues declined as a proportion of GDP and total tax revenues. GDP = gross domestic product.

Conclusion

There are many forest conservation policy approaches that can be taken; however, some may be more effective for low-income countries. While regulatory approaches (like standards or bans) can be quite effective at achieving policy objectives, they require adequate administrative and enforcement capacity and can be less efficient than economic instruments. However, economic instruments like results-based expenditure policies also require higher levels of governance capacity and are much costlier to implement (because of the introduction of new institutions and administrative arrangements), and some (like REDD+) rely on external donor funding. Environmental taxation, by contrast, is a low-cost policy that can be implemented unilaterally and, if well designed, can be effective even in countries characterized by low governance or administrative capabilities.

Environmental fiscal policy remains complementary to other forest conservation and management policies. Although environmental tax policy should be utilized much more than it currently is to incentivize forest conservation and sustainable management, it is not a silver bullet. Regulations, information instruments, and economic instruments like results-based expenditure policies, among others, are key components in a forest-smart policy mix.[41] Indeed, environmental taxation can improve the outcomes from other policies, helping policy makers achieve environmental and climate objectives at lower overall cost.

41 More details regarding complementary policy reforms for sustainable forest management can be found in World Bank (2019b, 2019a).

The remainder of this publication discusses various environmental taxation policies as well as other revenue-neutral or revenue-raising fiscal instruments that are well suited for low-capacity environments. A variety of environmental fiscal measures are available and, when well designed, can be implemented under a wide variety of governance arrangements. Key environmental tax instruments include reforms to existing forestry fiscal regimes, fee-and-rebate mechanisms, and environmental export taxes. Other revenue-neutral and revenue-raising environmental fiscal instruments include ecological fiscal transfers and the reduction of subsidies in other land use sectors that might be encouraging deforestation. Subsidy reform will also be a key policy strategy, especially for countries under budgetary constraints. If subsidies that currently promote deforestation and degradation can be reformed in accordance with climate-smart guidelines, this could free up additional revenues for countries to use toward accomplishing environmental, climate, or other national objectives. This publication does not present a comprehensive list of fiscal instruments that can help promote sustainable forests, but rather it represents a starting point for policy makers in low-capacity environments who are looking for manageable instruments that can also contribute toward domestic resource mobilization.

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