



Eighty-six EU policy options for reducing imported deforestation

Downloaded from: <https://research.chalmers.se>, 2025-12-10 00:26 UTC

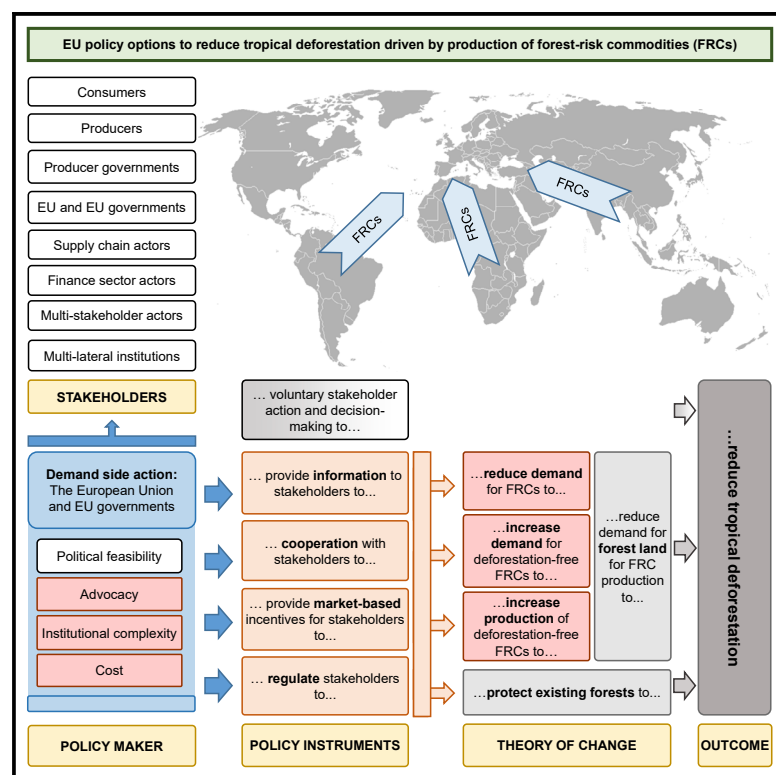
Citation for the original published paper (version of record):

Bager, S., Persson, M., dos Reis, T. (2021). Eighty-six EU policy options for reducing imported deforestation. *One Earth*, 4(2): 289-306. <http://dx.doi.org/10.1016/j.oneear.2021.01.011>

N.B. When citing this work, cite the original published paper.

Eighty-six EU policy options for reducing imported deforestation

Graphical Abstract



Authors

Simon L. Bager, U. Martin Persson,
Tiago N.P. dos Reis

Correspondence

simonbager@gmail.com (S.L.B.),
martin.persson@chalmers.se (U.M.P.)

In Brief

Images of distressed orangutans in Indonesia and forest fires in Brazil have increased public awareness of deforestation. Still, deforestation continues unabated, driven by demand for forest-risk commodities, such as palm and soy. Here, we present 86 policy options for the EU to reduce imported deforestation. We identify a trade-off between policy feasibility and potential impact. Mixing different policies and working with key stakeholders, supply chains, and producer regions can help overcome this trade-off.

Highlights

- From 1,141 proposals, we identify 86 EU policy options for reducing deforestation
- We assess the political feasibility to identify policy barriers
- Many policy options lack a proven theory of change for reducing deforestation
- We identify a trade-off between political feasibility and potential policy impact



Article

Eighty-six EU policy options for reducing imported deforestation

Simon L. Bager,^{1,3,*} U. Martin Persson,^{2,*} and Tiago N.P. dos Reis¹

¹Université Catholique de Louvain, Earth and Life Institute (ELI), Georges Lemaître Center for Earth and Climate Research (TECLIM), 3 Place Louis Pasteur, 1348 Louvain-la-Neuve, Belgium

²Chalmers University of Technology, Department of Space, Earth & Environment, Physical Resource Theory, 412 96 Gothenburg, Sweden

³Lead contact

*Correspondence: simonbager@gmail.com (S.L.B.), martin.persson@chalmers.se (U.M.P.)

<https://doi.org/10.1016/j.oneear.2021.01.011>

SCIENCE FOR SOCIETY Images of distressed orangutans in Indonesia and forest fires in Brazil have increased public awareness of deforestation across the globe. Still, deforestation continues more or less unabated, driven by demand for forest-risk commodities, such as palm, soy, cocoa, and beef. What can the European Union (EU) and other consumer regions do to address this problem? Here we present 86 policy options for the EU to address tropical deforestation, identified through a review of gray literature and EU stakeholder consultation responses. Analyzing these, we show that policy options that are politically feasible policies tend to have a weaker theory of change—the causal chain through which the policies address deforestation—setting up a trade-off between feasibility and impact. However, there are exceptions, such as mandatory due diligence, which show potential impact and appear politically feasible. Through policy mixing and working with key stakeholders, supply chains, and producer regions, these barriers can be overcome.

SUMMARY

Despite the importance of tropical forest conservation in achieving global sustainability goals and the key role of forest-risk commodity trade in driving deforestation, consumer country policy options for reducing imported deforestation have received limited scholarly attention. Drawing on gray literature and a European Commission public consultation, we identify 86 policy options for the European Union to address deforestation. We assess the political feasibility and map the “theory of change” (TOC)—the causal chain through which the policies address deforestation—for each of these policy options, identifying a trade-off between feasibility and potential impacts: information-based and cooperative policies, which dominate our sample, typically exhibit high feasibility, but mostly lack convincing TOCs, while more stringent regulatory and market-based policy options generally have lower feasibility. We propose three principles for overcoming the feasibility-impact dilemma: (1) build policies on proven TOCs, (2) use policy mixes, and (3) work with key stakeholders, supply chains, and regions.

INTRODUCTION

About 200 million hectares of forests—just under a tenth of the total forest area—have been lost across the tropics since the turn of the century,¹ and even greater areas have been degraded.² As a result, deforestation is the second-largest source of greenhouse gas emissions, after fossil fuels,² and the primary driver of terrestrial biodiversity loss.³ The forest fires in Brazil,^{4,5} which were particularly critical in 2019–2020, have again put the spotlight on the plight of tropical deforestation, increasing public awareness of this issue across the world.

Protecting the remaining tropical forests is key to meeting several of the United Nations Sustainable Development Goals (SDGs),⁶ as tropical forests, among other ecosystem services, provide climate mitigation, water circulation, climate regulation, biodiversity protection, and livelihood support. Several international agreements aim to reduce deforestation, from SDG target 15.2 to “halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally” to the New York Declaration on Forests and the Paris Agreement. Unfortunately, none of these pledges are on track to be met.⁷ Despite public and private conservation efforts, tropical deforestation rates remain high—or have even accelerated—as new



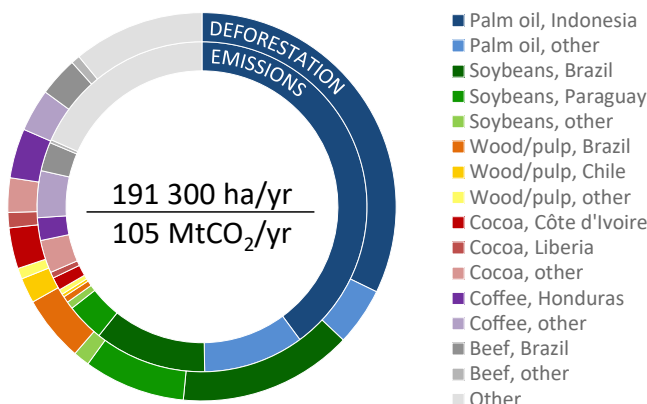


Figure 1. Deforestation risk and associated carbon emissions for EU imports of agricultural and forestry commodities in the period 2015–2017

FRCs imported into the EU carry a deforestation risk. Using data from Pendrill et al.,¹³ we calculated the total deforestation risk and associated carbon emissions of EU imports of agricultural and forestry FRCs in the period 2015–2017. Colors denote different commodities, while the hue indicates origin (see legend to the right). Light gray indicates all FRCs and regions not explicitly mentioned.

deforestation frontiers are opening in Africa and parts of Latin America previously spared from deforestation.^{7,8}

Production of forest and agricultural commodities is the main driver of deforestation across the tropics. Expanding cropland, pasture, and forest plantations account for approximately 60% of total forest loss.⁹ This expansion is, in turn, driven by increased demand for forest-risk commodities (FRCs) from consumers in rapidly growing urban areas in the countries of production and international markets.¹⁰

The European Union (EU) is among the leading international consumers of deforestation embodied in trade,¹¹ due to limited production of most FRCs, high per-capita consumption levels, and the presence of large food and feed industries.¹² From 2015 to 2017, EU imports of FRCs were associated with an estimated annual deforestation risk of 190,000 ha.¹³ This embodied deforestation was largely due to the import of palm oil, soybeans, forest products, cocoa, and coffee from a handful of countries (Figure 1). For some FRCs, EU imports constitute a large share of the global trade, especially cocoa and coffee, of which the EU imports more than 50% of global production, but also beef, rubber, palm oil, soy, and wood pulp.¹² Although the EU's relative import share of many FRCs has declined in recent years—in part due to growing demand by the Asian market, especially China—EU imports have been increasing in absolute numbers.¹²

The EU does not have direct regulatory competence on forests and currently no EU policy specifically addresses deforestation caused by FRCs.¹⁴ Deforestation is only partially covered through the EU Timber Regulation (EUTR), the Forest Law Enforcement and Governance (FLEG) Action Plan and related voluntary partnership agreements (VPAs) with producer countries, which aim to reduce imports of illegally harvested wood. The Renewable Energy and Indirect Land Use Change Directives indirectly address deforestation by targeting the deforestation risk associated with EU bioenergy demand. The EU also sup-

ports efforts to address deforestation through REDD+ (reducing emissions from deforestation and forest degradation) activities.

There is, however, an ongoing process to formulate a deforestation-specific EU policy. This process began in 2008, when the European Commission's (EC) first communication on deforestation was adopted,¹⁵ guiding the EC's efforts, though not constituting an official mandate to act. This was followed by studies,^{16–19} public consultation processes, and workshops,^{20,21} which have resulted in a Roadmap on Deforestation²² and an updated communication.²³ In 2019, the European Council adopted conclusions on the main principles of future EU actions to reduce imported deforestation resulting from EU consumption, an essential milestone in the process of the EU identifying if and how to regulate this topic. These conclusions gave the EC a mandate to develop policies and revise existing ones across its many policy areas affecting deforestation, including, among others, consumers, agriculture, development cooperation, research, trade, and finance. These principles also provide a clear sense of direction for EU member states (MSs) considering unilateral steps related to reducing deforestation for a particular commodity, industry, or geography. France²⁴ and Germany²⁵ have adopted broad policy plans for addressing imported deforestation. In 2020, the European Parliament published an own-initiative legislative report calling on the EC to take legislative action on deforestation,²⁶ following up with a European added-value assessment (EAVA) analyzing four demand-side regulatory policy options at the EU level.²⁷ As a follow-up to the EU communication,²³ a public consultation of potential regulatory options took place in 2020. This will feed into an EU Impact Assessment investigating various demand-side measures to address deforestation and forest degradation associated with EU consumption. The impact assessment is expected during 2021, with the eventual adoption of a proposal for regulation taking place thereafter.

With the issue firmly set on the EU agenda, there is currently a “policy window”²⁸ for addressing deforestation. Still, the role of consumer governments in reducing commodity-driven deforestation has so far received limited scholarly attention,²⁹ despite the contribution of internationally traded FRCs to overall deforestation.^{9,11} This paper aims to fill this research gap and inform the EU policy process by identifying and analyzing policy options for the EU and MSs to reduce tropical deforestation.

First, we map the option space for EU action on deforestation by compiling an extensive database of over 1,100 policy proposals from public consultations and gray literature. Using a proponent, instrument type, and target actor typology (see [Experimental procedures](#) and [Figure 5](#) for details), we consolidate this database into a smaller set of 86 unique policy options. Second, we assess these policy options based on two key determinants of potential policy impact: political feasibility and “theory of change” (TOC) ([Figure 2](#)).

Understanding the political feasibility of policy options is crucial for facilitating sustainability transitions.^{30,31} Here, we empirically assess three different determinants of political feasibility:^{32,33} advocacy, which measures the support for a policy across different actors; institutional setting, which captures the institutional complexity of defining and adopting a given policy; and costs, which expresses the magnitude and distribution of societal costs resulting from policy implementation.

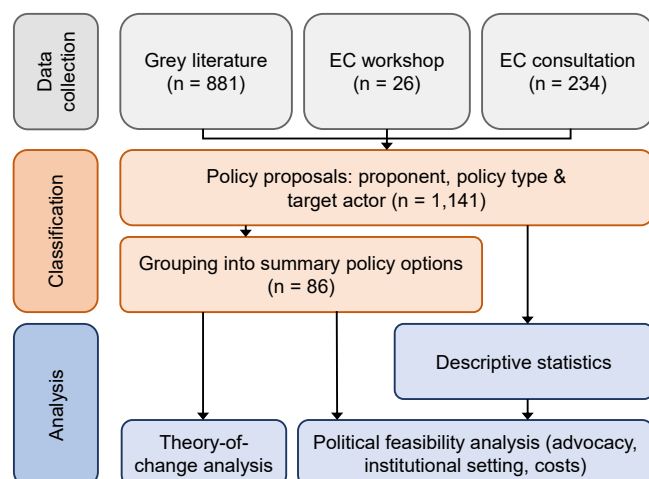


Figure 2. Methodology used to identify and analyze policy options
The boxes show the different steps of the methodology, from the collection of data on possible policy interventions from gray literature, a European Commission (EC) workshop in June 2017 and the EC's 2019 "Public Consultation on Stepping Up EU Action against Deforestation and Forest Degradation," to classification and analyses of theories of change and political feasibility. Each step is detailed under [Experimental procedures](#).

A TOC explains how and why a given policy intervention is expected to achieve change, detailing "who will do what differently and why."³⁴ A clearly elucidated TOC not only improves the chances that an intervention affects deforestation³⁵ by helping "identify assumptions, enabling factors and stumbling blocks,"³⁴ but also builds policy legitimacy by engaging stakeholders in a discussion on how to best achieve a given end.^{35,36} Here, we draw upon theoretical and empirical evidence to map the TOC underlying each of the identified policy options to facilitate a discussion of the potential impact of the identified policies on reducing imported deforestation.

By contrasting the TOC and feasibility assessments, we aim to identify feasible and impactful policy options for the EU to reduce deforestation. We end by discussing the implications of our findings for the EU policy agenda on deforestation and propose three principles to increase the feasibility and impact of policy action on deforestation.

RESULTS

Policy options

In reviewing the collected data, we identify 1,141 individual policy proposals put forward by the five types of proponents ([Figure 3](#)). By grouping these by target actor and policy instrument, we summarize the individual proposals in 86 unique policy options, which are proposed anywhere from 1 to 60 times ([Tables 1, 2, and 3](#)). The most frequently proposed option is to introduce mandatory due diligence regulation for companies importing FRCs, followed by support for multistakeholder fora, partnerships, and processes; capacity building for good governance in producer countries; and access to technology for FRC producers.

Information-based instruments ([Table 1](#)) constitute 30% of the 86 summary options and 19% of the individual proposals, and

mostly target supply-chain actors and consumer country governments. These proposals call for research, data collection, transparency, guidelines, and general information gathering and sharing by actors.

Cooperative policies ([Table 2](#)) are the most commonly proposed type across proponents, constituting 46% of the individual proposals and 37% of the summary options. Generally, these are measures to support various actors technically, financially, or procedurally, and except for consumers they target actor groups equally.

At the other end, market-based policies ([Table 3](#)) are proposed the least often across all proponents, constituting only 7% of the individual proposals and 13% of the summary options. Proposals overwhelmingly target supply-chain actors and include the use of taxes and subsidies, import tariffs, and reforming the EU's Common Agricultural Policy (CAP).

Regulatory measures ([Table 3](#)) cover 28% of the individual proposals and 21% of the summary options, with almost half the summary options aimed at supply-chain actors and another quarter at the financial sector. They include proposals for due diligence and transparency regulations, application of standards, and trade regulations. Together, market-based and regulatory policies make up less than a third of the summary options and only slightly above a third of the individual proposals.

Policy proponents and target actors

Of the 1,141 proposals, non-governmental organizations (NGOs) propose about half (47%), knowledge institutions (19%) and multistakeholder groups (21%) propose a fifth each, while industry (8%) and public authorities (4%) provide the fewest suggestions ([Figure 3](#)). Proponents make use of the four types of policy instrument to different degrees. At one end, industry and public authority proponents overwhelmingly provide proposals based on cooperative instruments and very few of the other policy instruments. At the other end, NGOs often suggest regulatory policy options. Knowledge-based proponents are the only group that proposes a greater-than-average number of policies relying on market-based and regulatory instruments and fewer relying on cooperative instruments.

Overall, supply-chain actors are the target of most policies (about a third of both individual proposals and summary options), followed by producer country governments and EU institutions. However, there are differences in the types of policies targeting different actors. Most cooperative policies are directed at producer governments, while most voluntary, market-based, and regulatory policies are directed at supply-chain actors.

Different proponent groups also target their proposals at different actor groups. Knowledge institutions direct information-based policies mostly at consumers and target EU institutions more often than other proponents. Public authorities direct information-based proposals mostly at EU actors, market-based proposals at producers, and cooperative proposals at multilateral institutions, but provide no proposals aimed at consumers and relatively few aimed at finance and supply-chain actors. Industry proponents' proposals target upstream actors (producers and producer governments) more often than other proponent groups' proposals. NGOs provide few proposals aimed at producers and consumers, targeting instead producer governments

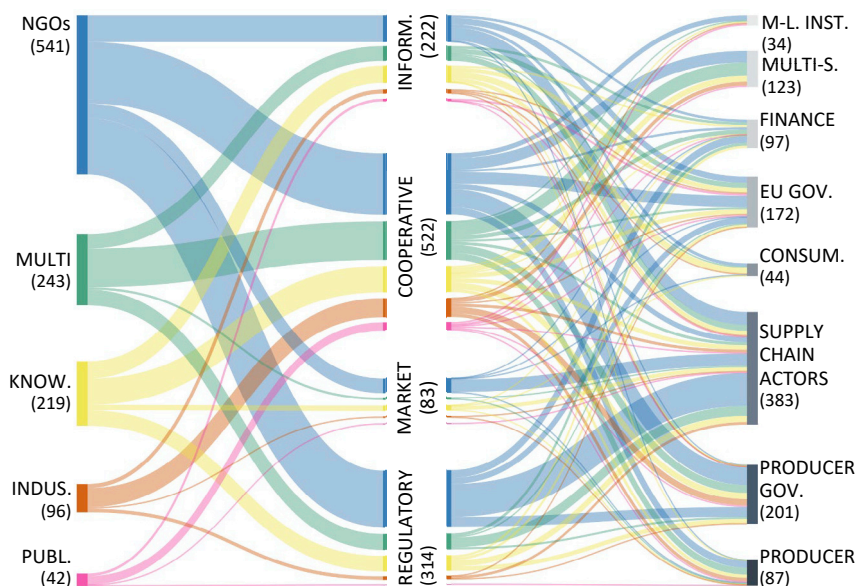


Figure 3. Graphical overview of the policies proposed by different actors, the types of policy instruments used, and the actors targeted by the policy

The left section displays the different actors (NGOs, non-governmental organizations; MULTI, multi-stakeholder groups; KNOW, knowledge institutions; INDUS, industry actors; and PUBL, public organizations). The middle section displays the policy instruments applied (information-based, cooperative, market-based, and regulatory). The right section displays the actors targeted by the policies (PRODUCER, FRC producers; PRODUCER GOV, producer governments; CONSUM, consumers; EU GOV, EU institutions and member states' governments; FINANCE, financial sector actors; MULTI-S, multistakeholder groups; M-L INST, multilateral institutions). Numbers in parentheses indicate the total number of policy proposals for a given category.

and especially supply-chain actors. Multistakeholder proponents provide proposals aimed at multistakeholder groups, producers, and finance actors, but infrequently target consumers and multilateral institutions.

Political feasibility

Tables 1, 2, and 3 present the assessment of the political feasibility of each of the 86 policy options across the three dimensions of feasibility assessed: advocacy, institutional setting, and costs. Overall, limited advocacy across proponent groups is the most significant barrier to feasibility, with 56 proposals classified as low support, 22 as moderate, and only 8 as high support, compared with a 3/32/51 split for institutional setting and 15/11/60 for costs.

To guide the assessment of feasibility, we divide the 86 summary options into clusters with similar combinations of feasibility across the three dimensions. One such cluster is policies that have an overall high level of feasibility ($n = 21$), defined as having one or more high feasibility scores and no low feasibility score across all three determinants. These can be contrasted with policies that face multiple feasibility barriers ($n = 21$), classified as either medium to low across all feasibility scores or as having at least two low scores across all three dimensions. The third and largest cluster contains policies facing advocacy barriers ($n = 44$), defined as having low feasibility score on advocacy, but one of either (or both) cost or institutional feasibility scoring high and the other medium (Figure S1).

The clusters are split almost entirely along policy instrument lines. The multiple-barriers cluster almost exclusively includes market-based and regulatory policies, such as trade policy, e.g., negotiating VPAs (RG2); trade provisions, e.g., tariffs, bans, quotas, sanctions, preferential access (MS1; RG1; RS4); or amendments to existing or development of new free-trade agreements (FTAs) (MG1) or World Trade Organization (WTO) rules (C11); supply-chain and finance regulations, e.g., mandatory labeling (RS7) or sustainability standards (RS3,5,8; RF3); and various economic incentives, e.g., taxing deforestation in

supply chains (MS2-3; MF1; MC1) or reforming subsidies and incentives in the CAP (MS4).

The two clusters of policies with high feasibility or advocacy as the main barrier mainly consist of information-based and cooperative policies. The high feasibility cluster contains three overarching types of policies. First are policies suggesting capacity building for FRC producers and producer countries (CP1,3; CG1,2,6, CM1). Second are policies aimed at EU actors' policy development and implementation (IE1; CE1,2) and EU consumption patterns (IC1; IE2). And third are policies targeting supply-chain actors, espousing, e.g., transparency, knowledge sharing, and certification and standards (IS1,4; CS1; CM1,2,4; CI2) and supporting multistakeholder processes (CM3). Notably, mandatory supply-chain due diligence (RS1) and transparency (RS2) policies also show high feasibility.

The advocacy-as-a-barrier cluster mainly includes policies targeting supply-chain and, in particular, finance actors to foster corporate sustainability practices (e.g., standards and guidelines [IS3; IF3-4; CS2,5-6; CM5], transparency [CS3; IF1], due diligence [IS6; IF2], or access to finance and technology [CS4,6; CF1,3]). Finance sector regulation, including mandatory due diligence and transparency (RF1,2) is also included in this cluster. A separate group of policies seek to raise consumers' awareness (IC2-4) and provide information to various stakeholders (e.g., monitoring progress on public and private deforestation targets [IG1,2; IS2]; sharing data [VE3-4], or developing labels [IS9]). Two market-based options, results-based payments (MP1) and subsidies to incentivize consumption of imperfect food (MS5) are also in this cluster, and notably both involve subsidies, rather than taxes or penalties.

Theories of change

Figure 4 displays the mapped TOC for each of the 86 summary options. This mapping is largely inferred, as proponents rarely explicate their TOCs. For example, individual policy proposals for food waste reduction targets or CAP reform do not describe

Table 1. Political feasibility of information-based policy options, by actor targeted

Policy proposal	No.	A/I/C
Forest-risk commodity producers		
IP1: Advocate for a reduced amount and increased environmental efficiency of FRC production	2	1/3/3
Producer governments		
IG1: Identify conservation hotspots	3	1/3/3
IG2: Monitor and identify jurisdictional/national progress toward zero deforestation	2	1/3/3
IG3: “Carding” system with countries exporting FRCs to the EU, issuing yellow or red cards to countries failing to act effectively to combat deforestation and illegal behavior in the supply chain	2	1/2/3
Supply-chain actors		
IS1: Encourage reporting, transparency, and public disclosure and access to information	24	2/3/3
IS2: Monitor progress on corporate commitments, pledges, and initiatives for deforestation	6	1/3/3
IS3: Define industry-wide sustainability criteria, such as zero deforestation and “sustainable” forestry and agricultural practices	14	1/3/3
IS4: Encourage the use of voluntary sourcing guidelines, certification, and joint/individual commitments	20	2/3/3
IS5: Encourage the use of residues, waste, and by-products and reduction of (food) waste	3	1/2/3
IS6: Promote due diligence for FRCs	1	1/3/3
IS7: Develop a blacklist of supply-chain operators not conforming to sustainability criteria	3	1/3/3
IS8: Develop a whitelist for suppliers who demonstrate and adhere to best practices for sustainability	2	1/3/3
IS9: Develop labels for origin, forest/carbon footprint, deforestation-free, etc.	12	1/2/3
Consumers		
IC1: Increase citizens’ awareness to reduce consumption of meat and FRCs and promote local, vegetable-based diets	28	2/3/3
IC2: Increase citizens’ awareness to reduce food waste	6	1/3/3
IC3: Increase citizens’ awareness to increase support for forest and climate policies	1	1/3/3
IC4: Use nudging, choice architecture, and behavioral approaches to promote sustainable consumption	4	1/3/3
EU governments		
IE1: Increase knowledge, research, and data collection	31	3/3/3
IE2: Promote sustainability criteria in public procurement and dietary guidelines	14	2/3/3
IE3: Increase transparency, information, and sharing of public data on land use and deforestation	10	1/3/3
IE4: Provide information and transparency on trade agreements	2	1/2/3
IE5: Increase international public commitments on climate (e.g., NDCs, nationally determined contribution) and land use (e.g., REDD+)	7	1/2/1
Finance actors		
IF1: Encourage traceability and transparency of financial flows involved in commodity production, trade, and consumption, e.g., using monitoring and reporting tools	6	1/3/3
IF2: Encourage due diligence for financial institutions	2	1/3/3
IF3: Encourage voluntary commitments on sustainability standards by financial actors	7	1/3/3
IF4: Provide guidelines, standards, or labels on sustainable or responsible investment, divestment, or green financial products	10	1/3/3

Summary policy options classified as information-based, by actor targeted. Numbers (No.) indicate the number of times each policy option was proposed in our sample. The political feasibility assessment is displayed (1, low; 2, medium; 3, high feasibility) for the three determinants: advocacy (A), institutional setting (I), and cost (C).

what actions to implement and how this would reduce deforestation. Also, some proposals seem to conflate means (e.g., increase transparency) with ends (i.e., reducing deforestation), thus providing normative statements as policies.

Overall, three-quarters of both individual proposals and summary options rely on reduced demand for forest land as a means of reducing deforestation. Only a tenth aims to reduce deforestation by protecting existing forests. To some extent, this finding is expected, as tropical forest protection is not within the purview

of EU policy, while factors influencing the demand for land for FRC production are. Finally, for about an eighth of the policies, it is unclear how their implementation would reduce deforestation, as the stated policy means’ ability to address the desired ends can be only vaguely or indirectly inferred.

Our mapping indicates three overall TOCs for reducing the demand for new forest land for FRC production: reducing overall demand for FRCs, increasing the demand for deforestation-free FRCs, and increasing the supply of deforestation-free

Table 2. Political feasibility of cooperative policy options, by actor targeted

Policy proposal	No.	A/I/C
Forest-risk commodity producers		
CP1: Provide access to technology, technical support, and training for better practices, sustainable intensification, climate-smart agriculture, and sustainable forest management	43	3/3/3
CP2: Provide access to finance and credit lines	8	1/3/3
CP3: Support alternative livelihoods and production systems	18	2/3/3
CP4: Support and scale-up cooperation, conflict resolution, and community monitoring	5	1/3/3
Producer governments		
CG1: Support capacity building for good governance, policy coordination, and enforcement of existing laws and regulations	59	3/3/2
CG2: Support forest conservation and restoration through technical capacity building, monitoring, research and data collection, etc.	36	3/3/3
CG3: Support sustainable agriculture in producer countries through technical capacity building (e.g., through official development assistance [ODA])	13	1/3/3
CG4: Support tax and tariff reform in exporting countries to promote sustainable production of FRCs	6	1/3/2
CG5: Make ODA and other financial support mechanisms conditional on sustainable production and deforestation targets	3	1/3/2
CG6: Support establishment and enforcement of tenure and land rights, human rights, and free, prior, and informed consent (FPIC)	20	2/3/3
Supply-chain actors		
CS1: Support uptake and implementation of existing production standards (e.g., sustainability criteria, certification, zero deforestation)	22	2/3/3
CS2: Support the development of new guidelines, criteria, standards, and roadmaps	8	1/3/3
CS3: Support for traceability and transparency	6	1/3/3
CS4: Support and improve access to finance for alternative business models, product service systems, and sharing platforms	8	1/3/3
CS5: Support the uptake of and compliance with procurement policies and other sourcing guidelines	4	1/3/3
CS6: Support industry commitments through technical capacity building for monitoring, data collection, etc.	8	1/3/3
EU governments		
CE1: Mainstream deforestation concerns in EU policies and promote synergy between policy areas	32	3/2/3
CE2: Improve implementation of existing EU policies (e.g., FLEGT, RED I and II) related to deforestation	21	2/3/3
CE3: Formulate and implement an EU action plan (on deforestation, sustainable agriculture)	8	1/3/3
CE4: Strengthen institutional capacity and cross-ministerial cooperation	11	1/2/3
Finance actors		
CF1: Support the development of a responsible investment framework (e.g., environmental, social, and governance [ESG] criteria) and mechanisms for internal monitoring and external compliance	3	1/3/3
CF2: Support innovative financial mechanisms for sustainable production, including blending instruments and public-private, results-based, and up-front financing	14	2/3/3
CF3: Provide insurance, guarantees, and reinsurance mechanisms to de-risk investments in sustainable land use	9	1/3/3
Multistakeholder		
CM1: Promote dialogue and cooperation with other producer and consumer countries	29	3/3/3
CM2: Alignment and harmonization of international, national and private-sector definitions, targets and commitments	9	2/3/3
CM3: Support multistakeholder fora, partnerships, and processes (jurisdictional or commodity roundtables, moratoria, etc.)	61	3/3/3
CM4: Facilitate data collection and information sharing among stakeholders	15	2/3/3
CM5: Strengthen certifications (e.g., through robust auditing and monitoring systems and effective complaints mechanisms)	9	1/3/3
Multilateral institutions		
CI1: Support reform of World Trade Organization rules based on sustainability considerations	4	1/3/1
CI2: Support implementation of existing commitments, treaties, and initiatives (e.g., Paris Agreement, REDD+, Convention on Biological Diversity [CBD])	12	2/2/1

(Continued on next page)

Table 2. Continued

Policy proposal	No.	A/I/C
CI3: Support additional sustainability efforts within multilateral institutions (e.g., World Bank, UN)	12	1/2/3
CI4: Support development of binding international treaties and regulations on business and sustainability	6	1/2/3

Summary policy options classified as cooperative, by actor targeted. Numbers (No.) indicate the number of times each policy option was proposed in our sample. The political feasibility assessment is displayed (1, low; 2, medium; 3, high feasibility) for the three determinants: advocacy (A), institutional setting (I), and cost (C).

FRCs. Reducing overall demand is the least prevalent of these TOCs. It is proposed to be achieved by limiting the EU bioenergy demand (RS6), shifting from meat to vegetable-based diets (IC1,4), reducing food waste (IC2; IS5; MS5), and reforming the EU CAP (MS4). However, the specific causal mechanisms for decreasing deforestation are seldom explicated.

The distinction between the TOCs aiming to increase, respectively, demand or supply for deforestation-free FRCs—constituting 30%–40% of all policy proposals each—is not always clear-cut. For example, proposals for supporting multistakeholder processes (CM3), developing new standards and certifications (CS2), or increasing the uptake of existing ones (CS1), may work to increase either supply or demand of deforestation-free FRCs.

Proposals to improve farmers' capacity (CP1–3) or the system in which they operate (CG1,6; CP4) have more evident TOCs. For example, promoting alternative production systems, training, technical assistance, and access to finance, or establishing good governance, ensuring land rights, or resolving local conflicts clearly aim to reduce deforestation by promoting the supply of deforestation-free FRCs. The same holds for policies seeking to ensure that investments are not directed to deforestation-related production.

Other policies aim to increase the demand for deforestation-free FRCs through different channels. A large group of policies aims to increase information or awareness on deforestation, e.g., through transparency (IS1; RS2; IF1; FR1; CS3), blacklists and whitelists (IS7,8), or monitoring capacity (IS2; CS6; IE1,3), with the (largely implicit) assumption that this will cause changes in corporate practices and consumer behavior. There are also suggestions for more directly shifting FRC consumption patterns, e.g., through sustainability criteria for public procurement (IE2; RE2) or by trade measures of various degrees of scope and stringency, such as negotiating VPAs (RG2), applying sustainability trade provisions (tariffs, bans, quotas, sanctions, preferential access) (MS1), or amending existing FTAs or WTO rules (RG1; CI1). Included here is also the popular option to use due diligence (RS1; IS6) to hold importers accountable for actions in their supply chain to increase demand for deforestation-free FRCs.

Most policies seeking to reduce deforestation by protecting existing forests do so by increasing capacity among local authorities and stakeholders, through technical and financial assistance (CG1–2; CP4). These policies espouse good governance and enforcement of laws; various forms of technical support, e.g., forest monitoring; and initiating funds to finance forest protection. Another set of policies provides financial incentives to preserve forests, either by directly paying landowners for forest conservation (MP1) (similar to or directly referring to REDD+) or by making development assistance to exporters of FRCs contingent on halting deforestation (CG5).

Although the TOCs displayed in Figure 4 outline “who would do what differently,” they do not always clearly elucidate “why,” partly because this is not always explicated in the policy proposals, and partly because there are sometimes different answers to that question. For example, the uptake of certifications, standards, transparency, and due diligence can be either supported or mandated. The difference between how these TOCs are realized has implications for their validity and eventual impact on reducing imported deforestation, which we discuss below.

DISCUSSION

The lack of clearly elucidated TOCs for most policy proposals is striking. Still, our attempt to infer underlying TOCs should be regarded as only a first step in informing the EU policy debate on reducing imported deforestation. As stressed by Garcia et al.,³⁵ TOCs need to be constantly revisited in “a dynamic process, [where] the TOC can support the collective testing of assumptions.” This idea articulates a need to deepen the deforestation policy debate to enable informed discussions on how to design optimal policies. Here, it is critical to draw on the extensive evidence produced on drivers of tropical deforestation,^{9,37–39} addressing both the underlying drivers (e.g., consumption, technology) and the proximate causes (e.g., agricultural expansion, logging). Drawing upon empirical and theoretical literature, we discuss the inferred TOCs, with an eye to the relation between potential impact and our assessment of political feasibility.

Reducing deforestation by shifting EU FRC demand

Several TOCs rely on information to shift demand—both intermediate and final—either away from imported FRCs completely, e.g., through diet shifts (IC1), or to sustainably produced FRCs, e.g., through voluntary or mandatory supply-chain transparency (IS1, RS2). Overall, these suggestions show high feasibility, though advocacy is a potential barrier for some information-based policies (e.g., IS1–2,7–8; IC3; IF1; RS2). However, the assumed causal link between information provision and impact is questionable: information-based policies are highly dependent on context and phrasing,^{40,41} necessitating careful design to achieve change. “Nudging” and behavioral designs (IC4) address this issue, but are yet to be proven impactful on a large scale.⁴² Gardner et al.⁴³ also caution that increased supply-chain transparency can be used strategically by strong actors to strengthen their position or increase information fatigue. Information overload is already an issue for consumers⁴⁴ and there is strong empirical evidence that information alone does not shift consumption patterns.⁴⁵ Negative information typically has

Table 3. Political feasibility of market-based policy options (top, M) and regulatory policy options (bottom, R), by actor targeted

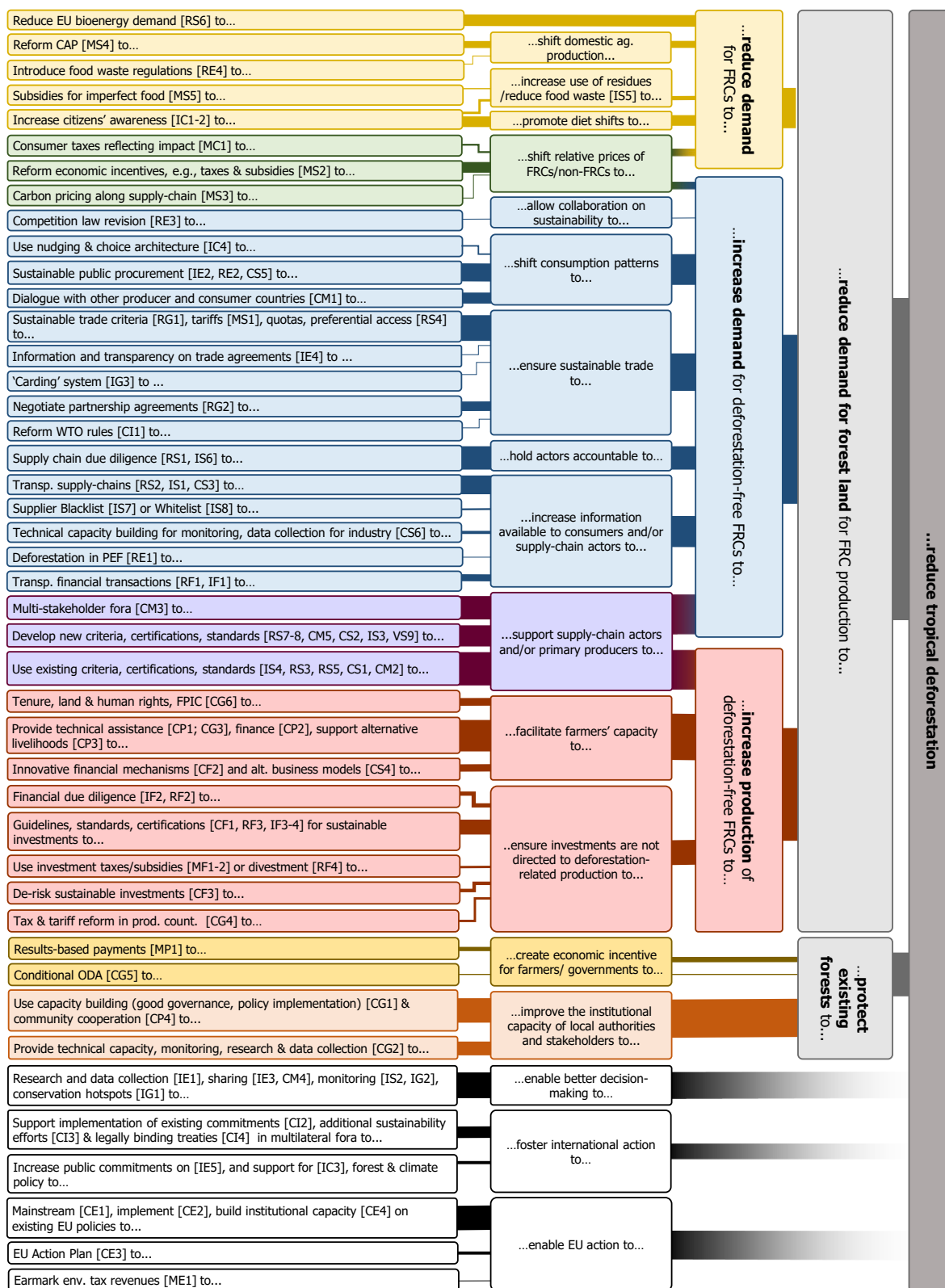
Policy proposal	No.	A/I/C
Forest-risk commodity producers		
MP1: Use results-based payments (e.g., carbon and ecosystem services markets such as REDD+, EU emissions trading scheme, verified emissions reductions) to promote sustainable production	11	1/2/3
Supply-chain actors		
MS1: Lower/raise import tariffs for sustainably/unsustainably produced commodities	14	2/2/1
MS2: Reform economic incentives (e.g., taxes and subsidies) for FRCs based on sustainability impacts	28	2/2/1
MS3: Introduce carbon pricing along the supply chain, including deforestation for FRCs	2	1/1/1
MS4: Reform EU CAP to reduce imported deforestation and promote sustainable agricultural production	18	2/2/1
MS5: Introduce subsidies for “imperfect” food products to reduce food waste	2	1/2/3
Consumers		
MC1: Introduce consumer taxes that reflect environmental impacts (e.g., deforestation, carbon emissions)	5	1/3/1
EU governments		
ME1: Environmental tax revenues for actions to reduce deforestation	1	1/3/1
Finance actors		
MF1: Introduce a tax on investment in companies linked to deforestation	1	1/2/2
MF2: Subsidize investments in sustainable/deforestation-free projects	1	1/2/2
Producer governments		
RG1: Include sustainability criteria and complaint mechanisms in current and future trade agreements	32	2/1/1
RG2: Negotiate partnership agreements (e.g., FLEGT-like VPAs) with producer countries	25	1/1/2
Supply-chain actors		
RS1: Mandatory due diligence regulation for companies importing FRCs	60	3/2/2
RS2: Mandatory transparency and reporting requirements	19	2/3/3
RS3: Mandatory regulatory standards (e.g., sustainability criteria, certification, high carbon stock [HCS]/high conservation value [HCV] approach)	28	2/2/1
RS4: Regulate imports, e.g., through quotas, bans, or preferential access agreements	21	2/2/1
RS5: Apply sanctions or prosecute companies not adhering to sustainability criteria	8	1/2/1
RS6: Limit EU bioenergy demand and strengthen sustainability criteria on bioenergy	30	2/2/1
RS7: Mandatory labeling of origin, forest/carbon footprint, deforestation-free, storage, etc.	6	1/2/2
RS8: Extend sustainability criteria for bioenergy to non-energy uses of the same commodities	6	1/2/1
EU governments		
RE1: Include land use and deforestation in the product environmental footprint regulation	1	1/2/3
RE2: Sustainability criteria and targets in public procurement policies	29	2/2/2
RE3: Review or amend EU competition law to allow businesses greater freedom to collaborate for sustainability purposes	2	1/2/3
RE4: Introduce food waste reduction goals and regulations	3	1/3/1
Finance actors		
RF1: Mandatory transparency and deforestation proofing for investments in agricultural and forestry supply chains	12	1/2/3
RF2: Mandatory due diligence requirements for EU financial institutions	9	1/2/3
RF3: Introduce regulation standards and criteria that ensure that finance from EU operators does not contribute to deforestation	19	1/2/2
RF4: Divest public funds from companies linked to deforestation and/or increase investments in sustainable consumption	4	1/3/2

Summary policy options classified as market-based (top) or regulatory (bottom), by actor targeted. Numbers (No.) indicate the number of times each policy option was proposed in our sample. The political feasibility assessment is displayed (1, low; 2, medium; 3, high feasibility) for the three determinants: advocacy (A), institutional setting (I), and cost (C).

broader impacts on consumer choices,^{46,47} but requires mandatory labeling (RS7), which shows scant support in our data.

Another way to realize demand shifts is by pricing deforestation embodied in FRC products (or their associated carbon emis-

sions) (MS1-2). These proposals face several feasibility barriers and are likely to have limited impact on deforestation, at least if implemented as consumption taxes. Carbon taxation of food shows relatively modest consumption changes due to low



(legend on next page)

demand elasticities.^{48,49} As most FRCs are intermediate inputs to processed products (e.g., palm oil, soybeans, rubber, wood products), consumer price changes are comparatively lower, making FRC taxes more effective if levied on supply-chain actors. Importantly, to have an impact, tax levels on FRCs must be differentiated by the relative contribution to deforestation, which complicates implementation and raises information needs tremendously.

Reforming CAP regulations^{50,51} (MS4), which include market- and trade-distorting provisions such as import tariffs and sector aid,^{16,52} could address deforestation by incentivizing increased EU production of FRC substitutes, primarily livestock feed, but also vegetable-based protein to substitute for meat. However, reforming the CAP is institutionally complex^{53,54} and faces strong opposition from some actors, making this a difficult option for reducing FRC demand.

Trade measures (MS1; RG1-2; RS4; CI1) provide an obvious avenue for addressing FRC imports, but these options face substantial feasibility barriers. Amending existing trade measures to consider deforestation—e.g., reducing tariffs for deforestation-free agricultural commodities^{16,55}—could ease feasibility concerns, but show limited impact due to the low tariffs on most agricultural products. There are critical legal and financial constraints to generally applied, stringent trade measures on FRCs, such as tariff increases, sanctions, and bans, imposed by WTO rules and existing EU law.⁵⁵ Including strict sustainability criteria in FTAs (RG1) can reduce deforestation, but the current Mercosur agreement illustrates the difficulty of utilizing this option.^{56,57} Similarly, negotiating FLEGT-style VPAs for FRCs (RG2) would enable the EU to target forest governance and production practices in tropical countries, but the cumbersome negotiation process and slow implementation⁵⁸ provides a barrier to near-term impacts. However, VPAs could be attractive in cases where the EU constitutes the main trading partner, e.g., for cocoa from West Africa.

Trade-based discrimination can be implemented under certain conditions.^{59,60} For example, the Illegal, Unreported, and Unregulated (IUU) Fishing Regulation⁶¹ applies a scheme to “validate” products entering the EU market and impose bans on imports (RS4, RG1), if exporters fail to implement required reforms promptly. It also operates a “carding system” for countries—similar to IG3—to incentivize cooperation and governance reforms.⁶² The similarities between IUU-related issues and deforestation make it obvious to draw on this policy. However, in addition to low feasibility, the geographically limited production of some FRCs, e.g., palm and cocoa, provides a barrier to redlists and import bans by reducing the number of trading partners available, while leakage remains an issue.⁶³

Reducing deforestation using supply-chain interventions

Our results clearly illustrate an increased focus on supply-chain sustainability interventions as a critical component of reducing deforestation, reflected also in the zero-deforestation commit-

ments made by a growing number of companies.^{7,64,65} Notably, using new or existing standards and certifications (IS3-4; IF3-4; CS1-2,5; CM5) to drive change among FRC producers, supply-chain actors, and financial institutions collectively accounts for the largest share of policy proposals. There is some empirical evidence that certification improves sustainability outcomes at the farm level,^{66,67} including farm tree cover.^{68–71} However, overall impacts on deforestation have been limited by certification leniency and insufficient market uptake.^{72–75} At present, demand for certified products trails supply for most FRCs.⁷⁶ To reduce deforestation, a viable TOC needs to explicate how stringent standards would move from niche to mainstream, overcoming the fundamental trade-off between impact and uptake for voluntary standards.^{77,78} Our analysis suggests this will be difficult, as proposals for making standards mandatory (RS3,7-8) face multiple feasibility barriers.

Multistakeholder processes (CM3) can foster synergies between policies and is a strongly supported, high-feasibility option. Although there is limited empirical evidence of how interactions between private and public governance regimes affect conservation policy,⁶⁷ incipient evidence shows that sector-wide standards resulting from multistakeholder dialogues—such as the Brazilian Soy Moratorium⁷⁹—can reduce deforestation, especially when combined with government support.⁶⁴ As illustrated by the soy moratorium, the impact of multistakeholder interventions depends on their ability to establish clear and stringent rules on deforestation and implement monitoring and enforcement mechanisms to ensure accountability,⁷⁹ even in the absence of supportive public governance frameworks. However, leakages risk undermining the overall impact of multistakeholder interventions by displacing deforestation to other territories,^{80–83} companies with less reputational risk,⁸⁴ or commodities (e.g., beef) with lower frontier entry costs.^{85,86}

Due diligence requirements introduce accountability provisions for supply-chain actors (RS1, IS6) and are the most common proposal in our sample, receiving widespread support across proponents. The support for mandatory adoption is crucial to achieving impact, as a recent evaluation found that “voluntary measures have not been effective in encouraging companies to identify, account and mitigate negative human rights and environmental impacts in their supply chains.”⁸⁷ Although mandatory due diligence regulation faces moderate feasibility barriers on institutional setting and costs, the EUTR⁸⁸ and Conflict Minerals⁸⁹ Regulations both apply due diligence and transparency measures, providing precedence that these barriers are surmountable.

Due diligence was included in the European Parliament’s EAVA report,²⁷ and the European Commission is expected to introduce a legislative proposal for mandatory human rights and environmental due diligence for EU companies in 2021. As the 2020 UK due diligence consultation⁹⁰ illustrates, the requirements and sanctions placed on key actors, such as large traders and producer groups, and the commodities included, affect overall impact. The French “duty of care” law (*Loi de Vigilance*)

Figure 4. Visualization of the theories of change (TOCs) underlying the 86 identified policy options

The boxes indicate the explicit or inferred actions and outcomes linking the policy options (left) and the goal of reducing deforestation (right), while the horizontal lines denote the causal links between these. The thickness of the lines denotes the number of policy proposals relying on the specific TOC. The specific policy options are mentioned in brackets, e.g., [RS6], referring to the specific policy options. For details about specific policy options, see Tables 1, 2, and 3.

instates due diligence for all companies of a specific size. Although it does not focus on a specific sector or issue, it includes a civil liability regime,⁹¹ holding companies accountable for breaches of the regulation.

Proposals for due diligence and increased transparency in finance (VF1-2; RF1-2) typically exhibit lower support (especially from industry and public authorities). Evidence from the Brazilian Amazon suggests that environmental criteria for restricting rural credit can effectively reduce deforestation.⁹² This measure, together with evidence of substantial ownership by EU-based financial actors and foreign investment flows into FRC operations, e.g., in the Amazon,^{93,94} suggests that including the finance sector in prospective EU regulations can reduce deforestation rates beyond that embodied in EU imports of FRCs. Within the EU process, options for regulating the financial sector include introducing investment standards for deforestation (RF3), taking broader action on environmental, social, and governance criteria in the financial sector (VF3; CF2-3), and implementing a sustainable finance taxonomy (CF1; VF4).

Reducing deforestation by supporting FRC producers

Although most policy options identified target actors within the EU, some prevalent TOCs target actors in producer countries. First, these include supporting FRC producers—financially (CP2; CS4; CF2), technically (CP1,3; CG3), or with regard to regulation (CP4; CG4,6)—to shift production practices and increase deforestation-free FRC production. Although these policies exhibit high feasibility, the causal links between support for FRC producers and reduced deforestation are far from straightforward and highly context dependent. There is ample evidence that “trade-offs and win-lose between forest conservation and technological progress in agriculture in areas near forests appear to be the rule rather than the exception” (p. 9)⁹⁵ This implies that supporting sustainable intensification may not have an impact on deforestation, especially if driven by demand for FRCs traded on global markets. Empirical evidence on the TOC for increased tenure security (CG6) is also mixed, generating increased or decreased deforestation depending on context,^{96–100} although interventions can reduce deforestation, if well designed. However, these policies risk creating stronger incentives for forest clearing for producers supplying international markets.

Options focusing on capacity building for FRC producer governments (CG1-2,4) have a lot in common with what has become the reality of REDD. However, direct references to REDD is surprisingly scant in the sampled data. This gap probably reflects a shift in the debate from government-led conservation policies promoted under REDD to supply-chain sustainability interventions and private sector action. Although exhibiting high feasibility overall, there is mixed empirical evidence of REDD policies reducing deforestation,^{101,102} although they have reduced deforestation in specific cases.¹⁰³ Martius et al.³⁴ argue that one reason for the failure of REDD to produce tangible reductions in deforestation is precisely the lack of—or different conceptions of—a TOC. REDD was initially conceived as a system to leverage international carbon markets to compensate tropical countries for reducing deforestation, but has evolved into a mostly aid-funded program with multiple objectives beyond forest conservation, where payments are seldom conditional on out-

comes.^{101,104–106} This suggests that moving toward the original REDD idea of conditional payments could increase impact.¹⁰⁵ However, there are also multiple challenges in implementing this (including feasibility), regardless of whether it is through results-based payment programs targeting farmers (MP1)¹⁰⁷ or making development aid conditional (CG5).¹⁰⁴

Resolving the feasibility-impact dilemma

The discussion above suggests a potential trade-off between feasibility and ability to directly address deforestation: the most feasible policy options—such as increased information, voluntary certification and standards, or technical capacity building—typically have relatively weak TOCs, while proposals with more viable TOCs (i.e., TOCs supported by both theoretical and empirical evidence)—mandatory certification and standards, trade measures, and supply-chain and finance regulations—appear less politically feasible. The apparent disjoint confirms the common perception of a trade-off between political feasibility and stringency (and assumed impact) in environmental policy interventions.³⁰

One way to overcome this dilemma is through policy mixing:^{30,108,109} combining policy options with varying cost, support, and institutional structure—and thus different implications for affected stakeholders—to create synergy that both increases stakeholder acceptance and improves overall impact.⁶⁷ Existing examples of policy mixing include private zero-deforestation initiatives and public policy support,⁶⁴ REDD efforts and FLEGT VPAs in producer countries,¹¹⁰ or combinations of costly and beneficial food policies.³⁰

Designing optimal policy mixes requires identifying the “low-hanging fruits,” i.e., feasible policy proposals building on viable and proven TOCs, while finding ways to overcome the feasibility barriers that make policies with convincing TOCs currently unfeasible. This includes actions that increase support (e.g., mixing “carrots” and “sticks”)¹¹¹ or reduce costs or complexity (e.g., limiting the FRCs included in the policy) to overcome resistance from key stakeholders. This also suggests that the assessment of feasibility and impact of individual policy interventions provided here must be complemented by studies on how policy mixing affects overall feasibility and impact.¹⁰⁹

From a policy-mixing perspective, support to producer countries can help legitimize more stringent interventions, by establishing the foundations on which such interventions rest. As such, broader support to producer country governments for better governance and tenure reform,¹¹² and adequate access to technical support, training, finance, etc., are important prerequisites for demand-side interventions.^{34,113} Existing EU policies, e.g., FLEGT and the IUU and Minerals Regulations, already apply collaborative efforts with producer countries as part of stronger, demand-side action. Supporting producer countries can also facilitate the successful implementation of industry supply-chain and jurisdictional initiatives currently ongoing in producer regions,^{64,65} making private-sector actors more supportive of such interventions. Note, however, the importance of including marginalized (e.g., smallholders or indigenous communities) groups in such deliberations, to ensure that they are not sidelined in the process.^{114,115}

EU’s deforestation footprint arises from imports of just a handful of FRCs (Figure 1), so targeting these likely makes the most

significant immediate contribution to reducing deforestation and increases the legitimacy of policy action. Working with key FRC producer countries also avoids the pitfall of good actors leaving bad places, resulting in deforestation risks merely shifting to less scrupulous traders, importers, and consumers. However, such a narrow policy approach is less resilient to changes in deforestation drivers, across commodities or countries, over time. Analyzing the “stickiness” of supply chains¹¹⁶ provides an option for mitigating this risk. Gradually extending regulations to other FRCs and regions over time, a process known as “policy sequencing,”¹¹⁷ and coordinating efforts with other consumer countries procuring large quantities of FRCs¹¹⁸ can mitigate the risk of deforestation leakage to other commodities or regions. Finally, the low feasibility of most options to reduce FRC demand highlights that many stakeholders perceive it as undesirable to interfere with consumer choice, possibly due to questions of agency,¹¹⁹ the direct perceptibility of such measures,³⁰ or fears of tackling their own base.

Our results also illustrate that policy support must be analyzed in a broader context than public acceptability alone.³⁰ Industry, knowledge institutions, and multistakeholder groups play a central role in formulating and advocating for policy options, emphasizing the need to understand opposition and support from these stakeholders as a critical component of political feasibility. The development of the EUTR shows that mutual interests and alliances between NGOs and industry groups are conducive to the development of regulatory interventions, with policy change resulting from “competition and collaboration among coalitions.”¹²⁰ Similar coalitions exist for deforestation action, e.g., in the cocoa sector, where prominent industry actors and NGOs jointly voiced support for mandatory due diligence regulation,¹²¹ and in the European oil palm industry.¹²² In the United Kingdom, 22 companies recently urged the government to strengthen and tighten the proposed due diligence requirements for FRCs.¹²³ Identifying and working with such coalitions is crucial to ensuring broad policy support and building legitimacy.

Building on our analysis, we suggest three principles for mitigating the apparent trade-off between feasibility and impact in EU deforestation policy:

- i. *Implement policies based on clearly elucidated and proven TOCs.* Policy makers should employ policies proven to be successful in reducing imported deforestation—e.g., multistakeholder action enforced through strict accountability,^{79,124} restrictions on credit,⁹² and VPAs¹²⁵—and tailor policy design to the context, as the drivers of deforestation—and thereby the most optimal policy response—are affected by location, commodity production system, forest type, and socioeconomic and cultural context-dependent factors.^{37,126}
- ii. *Use policy mixes to create synergies and increase impact.* Understanding how different policy options complement and reinforce one another is critical for maximizing policy impact on deforestation, a perspective that is largely missing from existing policy proposals.
- iii. *Work with stakeholders in key supply chains and regions, broadening scope over time.* Broad political and financial support in both producer and consumer countries is neces-

sary to build the foundation for strong policy action and effective implementation of deforestation policies. Sequencing policies and gradually expanding scope over time can facilitate acceptance and reduce risks of leakage.

Conclusion

From a sample of 1,141 policy proposals, we identified 86 unique policy options for the EU to reduce imported deforestation. Most of these build on information-based and cooperative measures, while market-based and regulatory options are less favored. Policies overwhelmingly target supply-chain actors, with due diligence, transparency, and certifications as preferred policy options. Our feasibility assessment shows advocacy as a main barrier across policy types, with institutional and cost barriers mainly affecting market-based and regulatory policy options. On the other hand, policies exhibiting high political feasibility typically lack a clear TOC for how the specific intervention contributes to the reduction of deforestation, suggesting a trade-off between political feasibility and policy impact. Still, there are policies, which our analysis suggests are both politically feasible and able to reduce imported deforestation, in particular, mandatory due diligence for supply-chain (and finance) actors and interventions supported through multistakeholder processes. These and other policies identified here should be considered by EU and national policy makers. Building on the analysis and policies identified here and applying the three principles can help policy makers introduce policies with greater impact on deforestation, while ensuring political feasibility.

EXPERIMENTAL PROCEDURES

Resource availability

Lead contact

Further information and requests for resources should be directed to and will be fulfilled by the lead contact, Simon L. Bager at simon.bager@uclouvain.be, simonbager@gmail.com.

Material availability

This study did not generate new unique materials.

Data and code availability

The dataset used for this paper has been uploaded to the Zenodo data repository, where it is freely available (<https://doi.org/10.5281/zenodo.4443032>).

Identifying EU policies for reducing deforestation

To identify EU policy options to address deforestation, we followed a three-pronged approach. First, we reviewed gray literature sources to identify policy options presented by various stakeholders for addressing land use changes and deforestation. We applied a snowballing approach to identify reports and policy briefs by NGOs, business associations and industries, consultancies and knowledge institutions, and public entities since the publication of the first EU Plan for Deforestation (2008–2019). Second, we reviewed the suggestions presented during a 2-day workshop held in Brussels in June 2017 as part of the “EU Action Plan to address drivers of deforestation” project. Last, we reviewed submissions to the European Commission’s “Public Consultation on Stepping up EU Action against Deforestation and Forest Degradation,” open in the period January 12 to February 25, 2019,²⁰ excluding submissions by individual citizens. We did not include peer-reviewed articles, as the process for publication of scientific research differ substantially from that of other reports, which allow stakeholders to voice their “opinion” on a given topic.

We note that the proposals from the European Commission’s public consultation and workshop do not necessarily come from a representative sample of actors, as not all stakeholders have the means to participate in such events. It is, for example, likely that indigenous groups and stakeholders without a

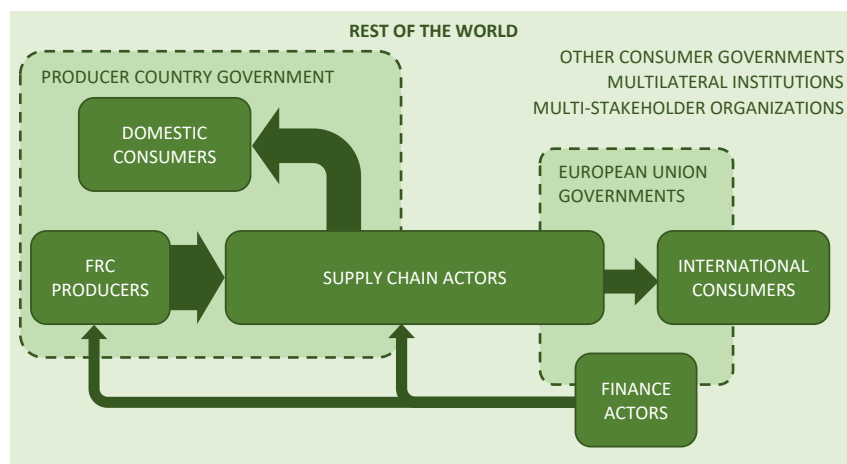


Figure 5. Identification and interaction of target actors for deforestation policy options

Actors of relevance to commodity-driven deforestation are displayed in green boxes of different shades and the arrows denote the links between these. FRC producers are producers of forest-risk commodities (FRCs), e.g., loggers, cattle ranchers, and farmers. Producer country governments include national and sub-national governments and agencies in countries subject to deforestation. Supply-chain actors across the FRC supply chains include, for example, slaughterhouses, oil palm mills, soy traders, feed producers, consumer goods companies, retailers, and other actors connecting the producers of FRCs to the final consumers. Consumers of FRCs include private individuals and public entities, both within the EU and outside. EU governments include both joint EU institutions (e.g., the EC Directorates-General, the European Council, and the Committee of the Regions) and MSs' governments and institutions, including ministries, agencies, and sub-national and regional govern-

ments. Finance actors include private and public entities, such as banks, investors, insurance companies, asset managers, and pension funds. Multistakeholder actors include multistakeholder arenas, such as commodity roundtables and multistakeholder organizations. Multilateral institutions include international and supranational organizations, such as the United Nations, the World Bank, and the World Trade Organization.

presence in Brussels or the EU are underrepresented in our sample. However, this is balanced by the gray literature review, which makes up the bulk of our data material. We also acknowledge that the sampling does not directly take into account large-scale advocacy campaigns and boycotts orchestrated by civil society to raise awareness of a particular issue, including deforestation. Such advocacy campaigns can play a role in shaping political awareness of deforestation^{127,128} and thus affect feasibility. Our assessment indirectly captures this, as it features publications by prominent civil society organizations, which often refer to related campaigns.

For all sources, we restricted the search to policy options for public, consumer country (e.g., EU) interventions, excluding options for producer country governments or private-sector actors. This sampling strategy resulted in 907 policy options from the literature and the workshop, and 234 suggestions from the public consultation. We classified each option as being proposed by one of five proponent groups: (1) NGOs, (2) industry, (3) knowledge institutions (e.g., academic institutions or think tanks), (4) public authorities (e.g., ministries, agencies), or (5) multistakeholder organizations (or multiproponent submissions).

Classifying target actors and policy instruments

We classified each of the 1,141 identified policy proposals based on two attributes: the actor targeted and the type of policy instrument proposed. This classification primarily serves a heuristic purpose, allowing us to group proposals in themes (actor-instrument combinations) and making it easier to summarize them in a smaller set of unique, non-overlapping policy options. However, this classification also facilitates an analysis of differences in the types of policies proposed by different actors—informing the policy feasibility assessment—as well as a discussion on the TOC underlying each proposal.

For the classification of actors targeted by the intervention, we distinguished between eight different groups of actors (Figure 5). Producers (and sometimes producer-country governments) represent the proximate (direct) drivers of deforestation, e.g., through agriculture, forestry, and infrastructure activities.^{7,37} Other actors jointly shape the underlying economic, institutional, demographic, and technological drivers that affect deforestation: consumers create the demand for FRCs, which supply-chain actors meet, sometimes enabled by finance actors who provide credit to actors along supply chains.⁹³ Producer governments set the regulatory environments that enable or restrict deforestation. They use legislation, monitoring, and enforcement of land use and forest conservation policies.³⁸ Consumer-country governments (e.g., the EU), in contrast, shape the regulatory space that consumers and supply-chain operators operate in. Finally, multistakeholder actors enable interaction between different actors, e.g., facilitating roundtables, fora, or joint organiza-

tions, while multilateral institutions, among other things, affect cross-national conduct of business.

Policy instruments are the tools by which regulators implement policies. They can be classified by the means with which policy makers seek to change the behavior of the actor targeted by the policy. A classical definition distinguishes between “sticks” (regulation), “carrots” (incentives), and “sermons” (information).¹¹¹ However, various classifications, mainly from public policy literature, include additional categories, e.g., “planning,” “cooperative,”¹²⁹ “partnering,” and “hybrid,”¹³⁰ to accommodate the specific policy process of various sectors (Table S1). For example, in the context of forest governance, Gupta et al.¹³¹ include “management” to account for processes in the field. Beyond sector-specific issues, instruments rely on different mechanisms to “influence collective action as a means of realizing political objectives” (p. 14)¹³² and thus vary in the degree of state/legislator intervention required. Further, as noted by Agrawal et al.,¹³³ different instruments require “varying forms and levels of resources to be adopted and implemented,” which means that some instruments are more costly (economically or technically) than others. To classify the policy instrument espoused by various proposals, we draw on these typologies to distinguish between four broad types of policy instruments, each of which relies on different mechanisms to affect actor behavior: (1) information-based, (2) cooperative, (3) market-based, and (4) regulatory policies (Table S2).

We divided the work of classifying policies on target actors and policy instrument types between ourselves. However, the results were cross-checked and classification disagreements resolved. We excluded from further analysis policy options that were too unclear, vague, or incoherently expressed to be assigned to an actor and a policy type. We summarized the remaining 1,141 policy suggestions into unique policy suggestions by each actor-instrument combination (8 × 4). We grouped together similar policy interventions targeting different commodities (e.g., due diligence). Two of us (S.L.B. and U.M.P.) jointly carried out this grouping process, resulting in 86 unique policy options for the EU to address deforestation.

Assessing political feasibility

A policy suggestion must be feasible to implement and likely to affect change to have an impact on the EU's contribution to deforestation, but assessing political feasibility and policy impact *ex ante* is fraught with difficulties. Assessing these two aspects is highly dependent on policy-specific design factors. For example, policy scope, i.e., geographical, temporal and sectorial, and policy stringency, understood as the relative internalization of environmental externalities compared with the counterfactual, affects both feasibility and impact, yet depends on policy-specific design factors. This also includes selecting

which biomes the policy targets, including defining what constitutes “a forest” and “deforestation.” Further, the specific context (e.g., political, cultural, historical, and technological) in which the policy is implemented also shapes policy outcomes.^{117,134,135} However, there are determinants of political feasibility and policy impact that are independent of these design and contextual factors.

Although there are hard constraints (e.g., laws of nature or logic) that rule out infeasible policy proposals, most policy constraints are soft (or malleable) and by their nature contextual. Thus, to ask if a policy proposal is feasible requires specifying feasible for whom, where, and when?^{136,137} Here, we assumed that the acting agent (*whom*) is an EU institution or MS, acting either individually or jointly to implement EU policies to address deforestation embodied in FRC trade (*where*). We further assumed that the context (*when*) is near-term action (pre-2030), implying that we would take institutional arrangements (formal and informal) and sociotechnical constraints to be more or less fixed. Although relaxing social, regulatory, or institutional constraints could have an impact on future feasibility of EU action on deforestation, we left this issue aside for future analyses.

To compare political feasibility across different policy options, we assessed three different determinants of feasibility:^{32,33} “advocacy,” i.e., actors supporting a given policy option; “institutional setting,” i.e., the institutional rules for defining and adopting a given policy; and “costs,” i.e., magnitude and distribution of societal costs resulting from policy implementation. For all summarized policy options, we awarded a score (low, medium, high feasibility) for each of the three determinants, according to the following (mostly qualitative) criteria (Table S3).

Advocacy

We assessed advocacy by quantifying the support for a given policy option among and across different proponents in our sample. The more widespread support was—measured as the strength of support for a policy across different proponent types—the higher its advocacy score. We acknowledge that this measure of policy support is crude; it measures only support of, not opposition to, a policy and does not account for differences in political clout between actors, for example. As such, the measure highlights where there is broad positive support for a given policy proposal, as it is not based on stated policy preferences among all actors.

Institutional setting

Institutional setting aims to capture the procedural and technical constraints of policy making, including defining and implementing the policy. We used the institutional involvement required by different actors during policy development and implementation to assess the institutional setting. The capacities required to design a policy and the political institutions able to define and implement it differ across policy options. In one form, a policy might be institutionally complex, while only minor adjustments to the policy can reduce the complexity significantly, and vice versa. Defining institutional setting involves subjective judgment and is reflective of the scope and context, yet, it remains an important metric to gauge the political feasibility of a policy.

Monetary costs

We took a qualitative approach to assessing policy cost, assuming that the impact that cost has on feasibility can be proxied by the type of costs a policy incurs and the magnitude of the cost streams affected by the policy. These include not only direct costs (costs for implementing or complying with the policy), but also indirect societal costs (e.g., impacts on prices of goods and services, or increased transaction costs).¹³⁸ Policies incurring only direct costs are more likely to be feasible than policies having potentially high indirect (economy-wide) costs, unless these direct costs are very substantial. The larger the monetary streams affected, the more likely it is that the policy will incur high indirect (economy-wide) costs. Moreover, higher absolute costs also risk having larger distributive effects, thus affecting political feasibility (cf. Jewell and Cherp³¹). Similarly, while some policies may be societally efficient (e.g., through potential double-dividend effects), they can incur considerable political resistance due to their redistributive effects on the economy.

Theory of change

Devising an optimal strategy for reducing imported deforestation requires an understanding of how different interventions lead to a reduction in deforestation—i.e., the causal chain through which the specific policy should reduce tropical deforestation—what is often called a *theory of change*. As illustrated by Martius et al.³⁴ for the case of REDD, TOCs are

often implicit, and different actors may have different conceptions of the TOC for a given intervention. To infer TOCs for our identified policy proposals (where they are not explicated in the data material), we drew upon the extensive theoretical and empirical literature on what drives and stops tropical deforestation.^{37,139,140} The starting point for this TOC mapping was the notion that there are two main ways in which commodity-driven deforestation can be reduced: (1) by protecting forests (analogous to increasing the forest conservation rent)¹⁴⁰ and (2) by reducing the demand for forest land for FRC production (analogous to reducing the rent of extensive agriculture).¹⁴⁰ We further identified three main sub-categories for reducing the demand for forest land: (2a) by reducing overall demand for FRCs, (2b) by increasing the demand for deforestation-free FRC production, or (2c) by increasing the supply of deforestation-free FRCs. By drawing up our classification of policy type and actor targeted, we were able to group policies based on the different ways in which they adhere to the specific strategies for achieving reductions in deforestation. We also identified policy options that did not clearly work through one of the two main ways of reducing deforestation. Mapping the TOC for deforestation was done for the 86 different policy options. The thickness of the line connecting the different boxes in Figure 4 corresponds to the number of proposals working through the given TOC, allowing us to identify the main TOCs proposed by the various stakeholders.

SUPPLEMENTAL INFORMATION

Supplemental information can be found online at <https://doi.org/10.1016/j.oneear.2021.01.011>.

ACKNOWLEDGMENTS

S.B. and T.N.P.d.R. acknowledge funding from the European Union’s Horizon 2020 Research and Innovation Programme under the Marie Skłodowska-Curie grant agreement 765408. U.M.P. acknowledges funding from the Swedish Research Council FORMAS, under grants 213:2014-1181 and 2016-00351 (LEAKAGE). The authors wish to thank Rasmus Einarsson for help with collating the European Commission consultation response and Jessica Jewel for insights on how to quantify political feasibility. Finally, we wish to thank Eric F. Lambin, Patrick Meyfroidt, and Florence Pendrill for helpful suggestions during the development of the manuscript. This research contributes to the Global Land Programme.

AUTHOR CONTRIBUTIONS

Conceptualization, S.B. and U.M.P.; investigation, S.B.; data curation, S.B., U.M.P., and T.N.P.d.R.; formal analysis, S.B. and U.M.P.; validation, S.B. and U.M.P.; methodology, S.B., U.M.P., and T.N.P.d.R.; writing – original draft, S.B. and U.M.P.; writing – editing, S.B. and U.M.P.

DECLARATION OF INTERESTS

S.L.B. contributed to three of the reports on deforestation from which policy proposals were extracted: COWI A/S et al. (2018), IDH (2019) and IDH (2020). S.L.B. was previously an employee of COWI A/S and has undertaken paid consultancy work for IDH and COWI A/S.

Received: September 7, 2020

Revised: November 29, 2020

Accepted: January 22, 2021

Published: February 19, 2021

REFERENCES

- Hansen, M.C., Potapov, P.V., Moore, R., Hancher, M., Turubanova, S.A., Tyukavina, A., Thau, D., Stehman, S.V., Goetz, S.J., Loveland, T.R., et al. (2013). High-resolution global maps of 21st-century forest cover change. *Science* 342, 850–853.
- IPCC (2019). *Climate Change and Land: An IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land*

- Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems, P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D.C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, and J. Malley, eds. (Intergovernmental Panel on Climate Change).
3. IPBES (2019). Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. In *Global Assessment Report on Biodiversity and Ecosystem Services*, S. Díaz, J. Settele, E.S. Brondizio, H.T. Ngo, M. Guèze, and J. Agard, et al., eds. (Bonn, Germany: IPBES secretariat), pp. 1–56, <https://doi.org/10.5281/zenodo.3553579>.
 4. Berenguer, E., Carvalho, N., Anderson, L.O., Aragão, L.E.O.C., França, F., and Barlow, J. (2020). Improving the spatial-temporal analysis of Amazonian fires. *Glob. Chang. Biol.* 27, 469–471.
 5. Barlow, J., Berenguer, E., Carmenta, R., and França, F. (2020). Clarifying Amazonia's burning crisis. *Glob. Chang. Biol.* 26, 319–321.
 6. Seymour, F., and Busch, J. (2016). Why Forests? Why Now?: The Science, Economics, and Politics of Tropical Forests and Climate Change (Center for Global Development).
 7. NYDF Assessment Partners (2019). Protecting and Restoring Forests: A Story of Large Commitments yet Limited Progress.
 8. FAO (2020). Global Forest Resources Assessment 2020 (FAO).
 9. Pendrill, F., Persson, U.M., Godar, J., and Kastner, T. (2019). Deforestation displaced: trade in forest-risk commodities and the prospects for a global forest transition. *Environ. Res. Lett.* 14, 055003.
 10. DeFries, R.S., Rudel, T., Uriarte, M., and Hansen, M. (2010). Deforestation driven by urban population growth and agricultural trade in the twenty-first century. *Nat. Geosci.* 3, 178–181.
 11. Pendrill, F., Persson, U.M., Godar, J., Kastner, T., Moran, D., Schmidt, S., and Wood, R. (2019). Agricultural and forestry trade drives large share of tropical deforestation emissions. *Glob. Environ. Chang.* 56, 1–10.
 12. IDH (2020). In The Urgency of Action to Tackle Tropical Deforestation: Protecting Forests and Fostering Sustainable Agriculture. Prepared for IDH by FACTS Consulting, COWI A/S and AlphaBeta Singapore, S.L. Bager, C. Schwöppe, M.L. Hoang, C.W. Swee, A.S. Olesen, C.C. Lan, and N. Sleurink, eds. (Utrecht, Netherlands: IDH - the Sustainable Trade Initiative).
 13. Pendrill, F., Persson, U.M., and Kastner, T. (2020). Deforestation Risk Embodied in Production and Consumption of Agricultural and Forestry Commodities 2005–2017 (Version 1.0) [Data Set] (Zenodo). <https://doi.org/10.5281/zenodo.4250532>.
 14. Pirlot, P., Delreux, T., and Farcy, C. (2018). Forests: a multi-sectoral and multi-level approach to sustainable forest management. In *European Union External Environmental Policy*, C. Adelle, K. Biedenkopf, and D. Torney, eds. (Springer International Publishing), pp. 167–187.
 15. European Commission (2008). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Addressing the Challenges of Deforestation and Forest Degradation to Tackle Climate Change and Biodiversity (Publications Office of the European Union).
 16. COWI, Ecofys, Milieu (2018). In Feasibility Study on Options to Step up EU Action against Deforestation, A.S. Olesen, S.L. Bager, D. Brack, M.S. Jespersen, D.S. Hansen, and L.C. Wähler, eds. (Publications Office of the European Union).
 17. Cuypers, D., Geerken, T., Gorissen, L., Lust, A., Peters, G., Karstensen, J., et al. (2013). The Impact of EU Consumption on Deforestation: Comprehensive Analysis of the Impact of EU Consumption on Deforestation (Publications Office of the European Union).
 18. Devriendt, N., Lust, A., Lemeire, C., Cuypers, D., Prieler, S., Fisher, G., et al. (2013). The Impact of EU Consumption on Deforestation: Proposal of Specific Community Policy, Legislative Measures and Other Initiatives for Further Consideration by the Commission (Publications Office of the European Union).
 19. Devriendt, N., Lust, A., Lemeire, C., Cuypers, D., Prieler, S., Fisher, G., et al. (2013). The Impact of EU Consumption on Deforestation: Identification of Critical Areas where Community Policies and Legislation Could Be Reviewed (Publications Office of the European Union).
 20. European Commission (2019). Public Consultation on Stepping up EU Action against Deforestation and Forest Degradation (European Commission). <https://ec.europa.eu/environment/forests/deforestation.htm>.
 21. European Commission (2017). European Commission Conference on Illegal Logging and Deforestation 21–23 June 2017. In Conference on Illegal Logging and Deforestation 21–23 June 2017, pp. 1–16. https://ec.europa.eu/environment/forests/conf_21_06_2017.htm
 22. European Commission (2018). Roadmap. Ref. Ares(2018)6516782 (European Commission). <https://ec.europa.eu/environment/forests/deforestation.htm>.
 23. European Commission (2019). Stepping up EU Action to Protect and Restore the World's Forests (European Commission). <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1565272554103&uri=CELEX:52019DC0352>.
 24. Ministère de la Transition Écologique et Solidaire (2018). Stratégie nationale de lutte contre la déforestation importée: 2018–2030 (National strategy to combat imported deforestation: 2018–2030) (Ministère de la Transition Écologique et Solidaire). https://www.ecologie.gouv.fr/sites/default/files/2018.11.14_SNDI_0.pdf.
 25. Bundesministerium für Ernährung und Landwirtschaft (2016). Leitlinien der Bundesregierung zur Förderung von entwaldungsfreien Lieferketten von Agrarrohstoffen (Bundesministerium für Ernährung und Landwirtschaft). https://www.bmel.de/SharedDocs/Downloads/DE/_Wald/leitlinien-entwaldungsfreie-lieferketten.html.
 26. Burkhardt, D. (2020). Motion for a European Parliament Resolution with recommendations to the Commission on an EU legal framework to halt and reverse EU-driven global deforestation (2020/2006(INL)). *Eur. Parliam.* 1–10. https://www.europarl.europa.eu/doceo/document/A-9-2020-0179_EN.html#title1.
 27. Heflich, A. (2020). An EU Legal Framework to Halt and Reverse EU-Driven Global Deforestation: European Added Value Assessment (European Parliament). [https://www.europarl.europa.eu/RegData/etudes/STUD/2020/654174/EPRS_STU\(2020\)654174_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2020/654174/EPRS_STU(2020)654174_EN.pdf).
 28. Kingdon, J.W. (1984). *Agendas, Alternatives and Public Policies* (Little, Brown).
 29. Schilling-Vacaflor, A., and Lenschow, A. (2019). Bringing the State back in: exploring new public environmental policy approaches for governing the Brazil-Europe soy chain. In *International Public Policy Association (IPPA) Conference*, pp. 1–21.
 30. Fesenfeld, L.P., Wicki, M., Sun, Y., and Bernauer, T. (2020). Policy packaging can make food system transformation feasible. *Nat. Food* 1, 173–182.
 31. Jewell, J., and Cherp, A. (2020). On the political feasibility of climate change mitigation pathways: is it too late to keep warming below 1.5°C? *Wiley Interdiscip. Rev. Clim. Chang.* 11, 1–12.
 32. Skodvin, T. (2007). Exploring the Notion of Political Feasibility in Environmental Policy (CICERO). https://pub.cicero.oslo.no/cicero-xmlui/bitstream/handle/11250/192286/CICERO_Working_Paper_2007-03.pdf.
 33. Majone, G. (1975). On the notion of political feasibility*. *Eur. J. Polit. Res.* 3, 259–274.
 34. Martius, C., Angelsen, A., Larson, A.M., Thuy, P.T., Sonwa, D.J., and Belcher, B. (2018). Pathway to impact. Is REDD+ a viable theory of change? In *Transforming REDD+: Lessons and New Directions* (Center for International Forestry Research), pp. 17–28.
 35. Garcia, C.A., Savilaakso, S., Verburg, R.W., Gutierrez, V., Wilson, S.J., Krug, C.B., Sassen, M., Robinson, B.E., Moersberger, H., Naimi, B., et al. (2020). The global forest transition as a human affair. *One Earth* 2, 417–428.

36. Sullivan, H., and Stewart, M. (2006). Who owns the theory of change? *Evaluation* 12, 179–199.
37. Geist, H.J., and Lambin, E.F. (2002). Proximate causes and underlying driving forces of tropical deforestation. *Bioscience* 52, 143.
38. Busch, J., and Ferretti-Gallon, K. (2017). What drives deforestation and what stops it? A meta-analysis. *Rev. Environ. Econ. Pol.* 17, 3–23.
39. Meyfroidt, P., Carlson, K.M., Fagan, M.E., Gutiérrez-Vélez, V.H., Macedo, M.N., Curran, L.M., DeFries, R.S., Dyer, G.A., Gibbs, H.K., Lambin, E.F., et al. (2014). Multiple pathways of commodity crop expansion in tropical forest landscapes. *Environ. Res. Lett.* 9, 074012.
40. Sunstein, C.R., and Reisch, L.A. (2013). Automatically green: behavioral economics and environmental protection. *Forthcoming. Harv. Environ. L. Rev.* 1–27.
41. Pollitt, M., and Shaorshadze, I. (2011). The Role of Behavioural Economics in Energy and Climate Policy (University of Cambridge). <https://doi.org/10.17863/CAM.5237>.
42. Reisch, L., Eberle, U., and Lorek, S. (2013). Sustainable food consumption: an overview of contemporary issues and policies. *Sustain. Sci. Pract. Policy* 9, 7–25.
43. Gardner, T.A., Benzie, M., Börner, J., Dawkins, E., Fick, S., Garrett, R., Godar, J., Grimard, A., Lake, S., Larsen, R.K., et al. (2019). Transparency and sustainability in global commodity supply chains. *World Dev.* 121, 163–177.
44. Iyengar, S.S., and Lepper, M.R. (2000). When choice is demotivating: can one desire too much of a good thing? *J. Pers. Soc. Psychol.* 79, 995–1006.
45. Horne, R.E. (2009). Limits to labels: the role of eco-labels in the assessment of product sustainability and routes to sustainable consumption. *Int. J. Consum. Stud.* 33, 175–182.
46. Vanclay, J.K., Shortiss, J., Aulsebrook, S., Gillespie, A.M., Howell, B.C., Johanni, R., Maher, M.J., Mitchell, K.M., Stewart, M.D., and Yates, J. (2011). Customer response to carbon labelling of groceries. *J. Consum. Policy* 34, 153–160.
47. Van Dam, Y.K., and De Jonge, J. (2015). The positive side of negative labelling. *J. Consum. Policy* 38, 19–38.
48. Springmann, M., Mason-D'Croz, D., Robinson, S., Wiebe, K., Godfray, H.C.J., Rayner, M., and Scarborough, P. (2017). Mitigation potential and global health impacts from emissions pricing of food commodities. *Nat. Clim. Chang.* 7, 69–74.
49. Säll, S., and Gren, I. (2015). Effects of an environmental tax on meat and dairy consumption in Sweden. *Food Policy* 55, 41–53.
50. European Commission (2013). Regulation (EU) No 1308/2013 of 17 December 2013 Establishing a Common Organisation of the Markets in Agricultural Products and Repealing Council Regulations (EEC) No 922/72, (EEC) No 234/79, (EC) No 1037/2001 and (EC) No 1234/2007 (Publications Office of the European Union). <http://data.europa.eu/eli/reg/2013/1308/oj>.
51. European Commission (2013). REGULATION (EU) No 1305/2013 of the EUROPEAN PARLIAMENT and of the COUNCIL of 17 December 2013 on Support for Rural Development by the European Agricultural Fund for Rural Development (EAFRD) and Repealing Council Regulation (EC) No 1698/2005 (Publications Office of the European Union). <http://data.europa.eu/eli/reg/2013/1305/oj>.
52. Matthews, A. (2008). The European Union's common agricultural policy and developing countries: the struggle for coherence. *J. Eur. Integr.* 30, 381–399.
53. Matthews, A. (2018). The CAP in the 2021–2027 MFF negotiations. *Intereconomics* 53, 306–311.
54. Elliot, M., and Heath, A. (2000). The failure of CAP reform: a public choice analysis. *Lea Econ. Aff.* 42–48.
55. Brack, D., and Bailey, R. (2013). Ending Global Deforestation: Policy Options for Consumer Countries (Chatham House). https://www.chathamhouse.org/sites/default/files/public/Research/Energy,%20Environment%20and%20Development/0913pr_deforestation.pdf.
56. Kehoe, L., dos Reis, T.N.P., Meyfroidt, P., Bager, S., Seppelt, R., Kuemmerle, T., Berenguer, E., Clark, M., Davis, K.F., zu Ermgassen, E.K.H.J., et al. (2020). Inclusion, transparency, and enforcement: how the EU-mercosur trade agreement fails the sustainability test. *One Earth* 3, 268–272.
57. Fuchs, R., Brown, C., and Rounsevell, M. (2020). Europe's Green Deal offshores environmental damage to other nations. *Nature* 586, 671–673.
58. TERE (2016). Evaluation of the EU FLEGT Action Plan 2004–2014 (Publications Office of the European Union). <https://ec.europa.eu/environment/forests/pdf/FLEGT%20Eval%20Consultant%20Report%20EN.pdf>.
59. Brack, D. (2013). Combating Illegal Logging: Interaction with WTO Rules. (Briefing Paper) - EER BP 2013/0, 16 (Chatham House). https://www.chathamhouse.org/sites/default/files/public/Research/Energy%2C%20Environment%20and%20Development/0513bp_brack.pdf.
60. Brack, D. (2015). WTO Compatibility with EU Action on Deforestation (FERN). <https://www.fern.org/de/ressourcen/wto-compatibility-with-eu-action-on-deforestation-534/>.
61. European Commission (2008). EC Regulation 1005/2008 of 29 September 2008 Establishing a Community System to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing, Amending Regulations (EEC) No 2847/93, (EC) No 1936/2001 and (EC) No 601/2004 and Repealing Regulation (Publications Office of the European Union). <http://data.europa.eu/eli/reg/2008/1005/oj>.
62. European Commission (2020). Illegal Fishing. Dir. Marit. Aff. Fish. https://ec.europa.eu/fisheries/cfp/illegal_fishing_en.
63. Hutniczak, B., and Delpeuch, C. (2018). Combatting Illegal, Unreported and Unregulated Fishing: Where Countries Stand and where Efforts Should Concentrate in the Future (Organisation for Economic Co-operation and Development). [https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=TAD/FI\(2017\)16/FINAL&docLanguage=En](https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=TAD/FI(2017)16/FINAL&docLanguage=En).
64. Lambin, E.F., Gibbs, H.K., Heilmayr, R., Carlson, K.M., Fleck, L.C., Garrett, R.D., Le Polain De Waroux, Y., McDermott, C.L., McLaughlin, D., Newton, P., et al. (2018). The role of supply-chain initiatives in reducing deforestation. *Nat. Clim. Chang.* 8, 109–116.
65. Garrett, R.D., Levy, S., Carlson, K.M., Gardner, T.A., Godar, J., Clapp, J., Dauvergne, P., Heilmayr, R., le Polain de Waroux, Y., Ayre, B., et al. (2019). Criteria for effective zero-deforestation commitments. *Glob. Environ. Chang.* 54, 135–147.
66. DeFries, R.S., Fanzo, J., Mondal, P., Remans, R., and Wood, S.A. (2017). Is voluntary certification of tropical agricultural commodities achieving sustainability goals for small-scale producers? A review of the evidence. *Environ. Res. Lett.* 12, 033001.
67. Lambin, E.F., Meyfroidt, P., Rueda, X., Blackman, A., Börner, J., Cerutti, P.O., Dietsch, T., Jungmann, L., Lamarque, P., Lister, J., et al. (2014). Effectiveness and synergies of policy instruments for land use governance in tropical regions. *Glob. Environ. Chang.* 28, 129–140.
68. Takahashi, R., and Todo, Y. (2013). The impact of a shade coffee certification program on forest conservation: a case study from a wild coffee forest in Ethiopia. *J. Environ. Manage.* 130, 48–54.
69. Carlson, K.M., Heilmayr, R., Gibbs, H.K., Noojipady, P., Burns, D.N., Morton, D.C., Walker, N.F., Paoli, G.D., and Kremen, C. (2018). Effect of oil palm sustainability certification on deforestation and fire in Indonesia. *Proc. Natl. Acad. Sci. U S A* 115, 121–126.
70. Rueda, X., and Lambin, E.F. (2013). Linking globalization to local land uses: how eco-consumers and gourmards are changing the Colombian coffee landscapes. *World Dev.* 41, 286–301.
71. Rueda, X., Thomas, N.E., and Lambin, E.F. (2015). Eco-certification and coffee cultivation enhance tree cover and forest connectivity in the Colombian coffee landscapes. *Reg. Environ. Chang.* 15, 25–33.
72. van der Ven, H., Rothacker, C., and Cashore, B. (2018). Do eco-labels prevent deforestation? Lessons from non-state market driven

- governance in the soy, palm oil, and cocoa sectors. *Glob. Environ. Chang.* 52, 141–151.
73. Morgans, C.L., Meijaard, E., Santika, T., Law, E., Budiharta, S., Ancyrenaz, M., and Wilson, K.A. (2018). Evaluating the effectiveness of palm oil certification in delivering multiple sustainability objectives. *Environ. Res. Lett.* 13, 064032.
74. Thoriakson, T., de Zegher, J.F., and Lambin, E.F. (2018). Companies' contribution to sustainability through global supply chains. *Proc. Natl. Acad. Sci. U S A* 115, 2072–2077.
75. Bager, S.L., and Lambin, E.F. (2020). Sustainability strategies by companies in the global coffee sector. *Bus. Strateg. Environ.* 29, 3555–3570.
76. Potts, J., Lynch, M., Wilkings, A., Huppé, G., Cunningham, M., and Voora, V. (2014). The State of Sustainability Initiatives Review 2014: Standards & the Green Economy (International Institute for Sustainable Development). <https://www.iisd.org/publications/state-sustainability-initiatives-review-2014-standards-and-green-economy>.
77. Borck, J.C., and Coglianese, C. (2009). Voluntary environmental programs: assessing their effectiveness. *Annu. Rev. Environ. Resour.* 34, 305–324.
78. Dietz, T., Auffenberg, J., Estrella Chong, A., Grabs, J., and Kilian, B. (2018). The voluntary coffee standard index (VOCSI). Developing a composite index to assess and compare the strength of mainstream voluntary sustainability standards in the global coffee industry. *Ecol. Econ.* 150, 72–87.
79. Gibbs, H.K., Rausch, L., Munger, J., Schelly, I., Morton, D.C., Noojipady, P., Soares-Filho, B., Barreto, P., Micol, L., and Walker, N.F. (2015). Brazil's soy moratorium. *Science* 347, 377–378.
80. Arima, E.Y., Richards, P., Walker, R., and Caldas, M.M. (2011). Statistical confirmation of indirect land use change in the Brazilian Amazon. *Environ. Res. Lett.* 6, 024010.
81. Gollnow, F., Hissa, L.de B.V., Rufin, P., and Lakes, T. (2018). Property-level direct and indirect deforestation for soybean production in the Amazon region of Mato Grosso, Brazil. *Land Use Policy* 78, 377–385.
82. Silva, C.A., and Lima, M. (2018). Soy moratorium in mato grosso: deforestation undermines the agreement. *Land Use Policy* 71, 540–542.
83. Lima, M., Silva Junior, C.A., da Rausch, L., Gibbs, H.K., and Johann, J.A. (2019). Demystifying sustainable soy in Brazil. *Land Use Policy* 82, 349–352.
84. Heron, T., Prado, P., and West, C. (2018). Global value chains and the governance of 'embedded' food commodities: the case of soy. *Glob. Policy* 9, 29–37.
85. Moffette, F., and Gibbs, H. (2021). Agricultural displacement and deforestation leakage in the Brazilian legal Amazon. *Land Econ.* 97, 1–55.
86. Garrett, R.D., Koh, I., Lambin, E.F., le Polain de Waroux, Y., Kastens, J.H., and Brown, J.C. (2018). Intensification in agriculture-forest frontiers: land use responses to development and conservation policies in Brazil. *Glob. Environ. Chang.* 53, 233–243.
87. Smit, L., Bright, C., McCorquodale, R., Bauer, M., Deringer, H., Baeza-Breinbauer, D., Torres-Cortés, F., Alleweldt, F., Kara, S., Salinier, C., et al. (2020). Study on Due Diligence Requirements through the Supply Chain (Publications Office of the European Union).
88. European Commission (2010). Regulation (EU) No 995/2010 of the European Parliament and of the Council of 20 October 2010 laying down the obligations of operators who place timber and timber products on the market (Publications Office of the European Union). <http://data.europa.eu/eli/reg/2010/995/oj>.
89. European Commission (2017). Regulation (EU) 2017/821 of the European Parliament and of the Council of 17 May 2017 laying down supply chain due diligence obligations for Union importers of tin, tantalum and tungsten, their ores, and gold originating from conflict-affected and high-risk areas (Publications Office of the European Union). <http://data.europa.eu/eli/reg/2017/821/oj>.
90. UK Department for Food Environment and Rural Affairs (2020). Due Diligence on Forest Risk Commodities - Defra - Citizen Space. <https://consult.defra.gov.uk/eu/due-diligence-on-forest-risk-commodities/>.
91. Cossart, S., Chaplier, J., and Beau De Lomenie, T. (2017). The French law on duty of care: a historic step towards making globalization work for all. *Bus. Hum. Rights J.* 2, 317–323.
92. Assunção, J., Gandour, C., Rocha, R., and Rocha, R. (2020). The effect of rural credit on deforestation: evidence from the Brazilian Amazon. *Econ. J.* 130, 290–330.
93. Galaz, V., Crona, B., Dauriach, A., Jouffray, J.-B., Österblom, H., and Fichtner, J. (2018). Tax havens and global environmental degradation. *Nat. Ecol. Evol.* 2, 1352–1357.
94. Galaz, V., Crona, B., Dauriach, A., Scholtens, B., and Steffen, W. (2018). Finance and the Earth system – exploring the links between financial actors and non-linear changes in the climate system. *Glob. Environ. Chang.* 53, 296–302.
95. Angelsen, A., and Kaimowitz, D. (2001). Agricultural Technologies and Tropical Deforestation (Center for International Forestry Research (CIFOR)). https://www.cifor.org/publications/pdf_files/Books/BAngelsen0101E0.pdf.
96. Blackman, A., Corral, L., Lima, E.S., and Asner, G.P. (2017). Titling indigenous communities protects forests in the Peruvian Amazon. *Proc. Natl. Acad. Sci. U S A* 114, 4123–4128.
97. Liscow, Z.D. (2013). Do property rights promote investment but cause deforestation? Quasi-experimental evidence from Nicaragua. *J. Environ. Econ. Manage.* 65, 241–261.
98. Robinson, B.E., Holland, M.B., and Naughton-Treves, L. (2017). Community land titles alone will not protect forests. *Proc. Natl. Acad. Sci. U S A* 114, E5764.
99. Robinson, B.E., Holland, M.B., and Naughton-Treves, L. (2014). Does secure land tenure save forests? A meta-analysis of the relationship between land tenure and tropical deforestation. *Glob. Environ. Chang.* 29, 281–293.
100. Probst, B., BenYishay, A., Kontoleon, A., and dos Reis, T.N.P. (2020). Impacts of a large-scale titling initiative on deforestation in the Brazilian Amazon. *Nat. Sustain.* 3, 373–395.
101. Duchelle, A.E., Simonet, G., Sunderlin, W.D., and Wunder, S. (2018). What is REDD+ achieving on the ground? *Curr. Opin. Environ. Sustain.* 32, 134–140.
102. West, T.A.P., Börner, J., Sills, E.O., and Kontoleon, A. (2020). Overstated carbon emission reductions from voluntary REDD+ projects in the Brazilian Amazon. *Proc. Natl. Acad. Sci. U S A* 117, 24188–24194.
103. Roopsind, A., Sohngen, B., and Brandt, J. (2019). Evidence that a national REDD+ program reduces tree cover loss and carbon emissions in a high forest cover, low deforestation country. *Proc. Natl. Acad. Sci. U S A* 116, 24492–24499.
104. Angelsen, A. (2017). REDD+ as result-based aid: general lessons and bilateral agreements of Norway. *Rev. Dev. Econ.* 21, 237–264.
105. Wunder, S., Duchelle, A.E., Sassi, C.de, Sills, E.O., Simonet, G., and Sunderlin, W.D. (2020). REDD+ in theory and practice: how lessons from local projects can inform jurisdictional approaches. *Front. For. Glob. Chang.* 3, 1–17.
106. Olesen, A., Böttcher, H., Siemons, A., Herrmann, L., Martius, C., Roman-Cuesta, R.M., et al. (2018). Study on EU Financing of REDD+ Related Activities, and Results-Based Payments Pre and Post 2020: Sources, Cost-Effectiveness and Fair Allocation of Incentives (Publications Office of the European Union). <https://doi.org/10.2834/687514>.
107. Börner, J., Baylis, K., Corbera, E., Ezzine-de-Blas, D., Honey-Rosés, J., Persson, U.M., and Wunder, S. (2017). The effectiveness of payments for environmental services. *World Dev.* 96, 359–374.
108. Börner, J., Marinho, E., and Wunder, S. (2015). Mixing carrots and sticks to conserve forests in the Brazilian Amazon: a spatial probabilistic modeling approach. *PLoS One* 10, e0116846.

109. Howlett, M. (2004). Beyond good and evil in policy implementation: instrument mixes, implementation styles, and second generation theories of policy instrument choice. *Policy Soc.* 23, 1–17.
110. Muir, G., Murray, J., Sartoretto, E., Hewitt, D., Simpson, R., and Fox, J. (2016). Coordinating climate action: experiences from REDD+ and FLEGT. *Unasylva* 67, 37–44.
111. Bemelmans-Videc, M.-L., Rist, R.C., and Vedung, E. (1998). *Carrots, Sticks & Sermons: Policy Instruments & Their Evaluation* (Routledge).
112. Robinson, B.E., Masuda, Y.J., Kelly, A., Holland, M.B., Bedford, C., Childress, M., Flutschner, D., Game, E.T., Ginsburg, C., Hilhorst, T., et al. (2018). Incorporating land tenure security into conservation. *Conserv. Lett.* 11, e12383.
113. Minang, P.A., Van Noordwijk, M., Duguma, L.A., Alemagi, D., Do, T.H., Bernard, F., Agung, P., Robiglio, V., Catacutan, D., Suyanto, S., et al. (2014). REDD+ Readiness progress across countries: time for reconsideration. *Clim. Policy* 14, 685–708.
114. Bastos Lima, M.G., and Persson, U.M. (2020). Commodity-centric landscape governance as a double-edged sword: the case of soy and the cerrado working group in Brazil. *Front. For. Glob. Chang.* 3, 1–17.
115. González, N.C., and Kröger, M. (2020). The potential of Amazon indigenous agroforestry practices and ontologies for rethinking global forest governance. *For. Policy Econ.* 118, 102257.
116. Reis, T.N.P.dos, Meyfroidt, P., zu Ermgassen, E.K.H.J., West, C., Gardner, T., Bager, S., Croft, S., Lathuillière, M.J., and Godar, J. (2020). Understanding the stickiness of commodity supply chains is key to improving their sustainability. *One Earth* 3, 100–115.
117. Pahle, M., Burtraw, D., Flachslund, C., Kelsey, N., Biber, E., Meckling, J., Edenhofer, O., and Zysman, J. (2018). Sequencing to ratchet up climate policy stringency. *Nat. Clim. Chang.* 8, 861–867.
118. Bastos Lima, M.G., Persson, U.M., and Meyfroidt, P. (2019). Leakage and boosting effects in environmental governance: a framework for analysis. *Environ. Res. Lett.* 14, 105006.
119. Creutzig, F., Roy, J., Lamb, W.F., Azevedo, I.M.L., Bruine De Bruin, W., Dalkmann, H., Edelenbosch, O.Y., Geels, F.W., Grubler, A., Hepburn, C., et al. (2018). Towards demand-side solutions for mitigating climate change. *Nat. Clim. Chang.* 8, 268–271.
120. Sotirov, M., Stelter, M., and Winkel, G. (2017). The emergence of the European Union Timber Regulation: how Baptists, Bootleggers, devil shifting and moral legitimacy drive change in the environmental governance of global timber trade. *For. Policy Econ.* 81, 69–81.
121. Callebaut, Barry, Fairtrade International, Wrigley, Mars, Mondeléz International, Rainforest Alliance, and VOICE. (2019). Joint Position Paper on the EU's Policy and Regulatory Approach to Cocoa (Voice Network). <https://www.voicenetwork.eu/wp-content/uploads/2019/12/Joint-position-paper-on-the-EUs-policy-and-regulatory-approach-to-cocoa.pdf>.
122. Business & Human Rights Resource Centre (2020). 26 Companies, Business Associations, and Initiatives Make Joint Call for EU Mandatory Human Rights & Environmental Due Diligence - Business & Human Rights Resource Centre. <https://www.business-humanrights.org/en/latest-news/eu-mandatory-due-diligence/>.
123. IDH - the Sustainable Trade Initiative (2020). Letter on UK Due Diligence Consultation, 3 (IDH - the Sustainable Trade Initiative). <https://www.idhsustainabletrade.com/tacklingdeforestation/>.
124. Nepstad, D., McGrath, D., Stickler, C., Alencar, A., Azevedo, A., Swette, B., Bezerra, T., DiGiano, M., Shimada, J., Seroa da Motta, R., et al. (2014). Slowing Amazon deforestation through public policy and interventions in beef and soy supply chains. *Science* 344, 1118–1123.
125. Jonsson, R., Giurca, A., Masiero, M., Pepke, E., Pettenella, D., Prestemon, J., et al. (2015). Assessment of the EU Timber Regulation and FLEGT Action Plan (European Forest Institute), From Science to Policy 1. https://efi.int/sites/default/files/files/publication-bank/2018/efi_fstp_1_2015.pdf.
126. Nagendra, H., and Ostrom, E. (2012). Polycentric governance of multi-functional forested landscapes. *International Journal of the Commons* 6, 104–133, <https://doi.org/10.18352/ijc.321>.
127. Dauvergne, P. (2017). Is the power of brand-focused activism rising? The case of tropical deforestation. *J. Environ. Dev.* 26, 135–155.
128. Sethi, S.P. (1994). *Multinational Corporations and the Impact of Public Advocacy on Corporate Strategy* (Springer Netherlands).
129. Juerges, N., and Hansjürgens, B. (2018). Soil governance in the transition towards a sustainable bioeconomy – a review. *J. Clean. Prod.* 170, 1628–1639.
130. Steurer, R. (2011). Soft instruments, few networks: how “new governance” materializes in public policies on corporate social responsibility across Europe. *Environ. Policy Gov.* 21, 270–290.
131. Gupta, J., Shin, H.Y., Matthews, R., Meyfroidt, P., and Kuik, O. (2013). The forest transition, the drivers of deforestation and governance approaches. In *Climate Change, Forests and REDD*, J. Gupta, N. van der Grijp, and O. Kuik, eds. (Routledge), pp. 25–51.
132. Böcher, M. (2012). A theoretical framework for explaining the choice of instruments in environmental policy. *For. Policy Econ.* 16, 14–22.
133. Agrawal, A., Hajjar, R., Liao, C., Rasmussen, L.V., and Watkins, C. (2018). Editorial overview: forest governance interventions for sustainability through information, incentives, and institutions. *Curr. Opin. Environ. Sustain.* 32, A1–A7.
134. Wilson, G.A., and Buller, H. (2001). The use of socio-economic and environmental indicators in assessing the effectiveness of EU agri-environmental policy. *Eur. Environ.* 11, 297–313.
135. Galeotti, M., Salini, S., and Verdolini, E. (2020). Measuring environmental policy stringency: approaches, validity, and impact on environmental innovation and energy efficiency. *Energy Policy* 136, 111052.
136. Gilbert, P., and Lawford-Smith, H. (2012). Political feasibility: a conceptual exploration. *Polit. Stud.* 60, 809–825.
137. Webber, D.J. (1986). Analyzing political feasibility: political scientists' unique contribution to policy analysis. *Policy Stud. J.* 14, 545–553.
138. Renda, A., Schrefler, L., Luchetta, G., and Zavatta, R. (2013). *Assessing the Costs and Benefits of Regulation* (Brussels, Belgium: Centre for European Policy Studies). <https://www.ceps.eu/ceps-publications/assessing-costs-and-benefits-regulation/>.
139. Ferretti-Gallon, K., and Busch, J. (2014). What drives deforestation and what stops it? A meta-analysis of spatially explicit econometric studies. *Cent. Glob. Dev. Work. Pap.* 367, 44.
140. Angelsen, A. (2010). Policies for reduced deforestation and their impact on agricultural production. *Proc. Natl. Acad. Sci. U S A* 107, 19639–19644.