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Do national strategies under the UN biodiversity and climate conventions address agricultural commodity consumption as deforestation driver?

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ABSTRACT

Forest conversion in the tropics is increasingly driven by global demand for agricultural forest-risk commodities such as soy, beef, palm oil and timber. In order to be effective, future forest conservation policies should include measures targeting both producers (the supply side) and consumers (the demand side) to address commodity-driven deforestation. Whereas the UN Conventions on Biodiversity (CBD) and Climate Change (UNFCCC) do not make reference to this driving factor, here we explore whether and how recent national strategies by member states to the Conventions acknowledge the role of agricultural commodities in tropical deforestation. A text analysis of 139 Intended Nationally Determined Contributions (INDCs) to climate change mitigation and 132 National Biodiversity Strategies and Action Plans (NBSAPs) shows that the general trade-off between national development aspirations and forest conservation is commonly acknowledged. However, only few strategies link deforestation to commodity production and consumption, whereas most documents do not mention this topic. This lack of reference to a key driver of tropical deforestation limits the prospects of safeguarding tropical forests for biodiversity and climate change mitigation purposes as part of the two UN Conventions, and might jeopardise their overall effectiveness.

These findings were complemented by a content analysis of INDCs, NBSAPs and REDD+ documents from eight case countries affected by commodity-driven deforestation. We investigated whether this driver is acknowledged in the national strategies, and which policy measures are suggested to address forest loss from agricultural commodities. We found that six case countries mention agricultural commodities as deforestation driver in their REDD+ documents, whereas the biodiversity and climate change strategies were silent on the topic. Policy measures targeting commodity production were suggested in four REDD+ strategies, ranging from incentive payments, sustainable agricultural practices and land-use planning to demand-side approaches such as certification and the promotion of sustainable lifestyles.

One conclusion from this exercise is that UN member states seem not to consider climate and biodiversity national plans the adequate forum to discuss detailed forest conservation approaches. We argue that in order to increase effectiveness, strategies under the UN Conventions should take commodity-driven deforestation into account, through measures that address both the producer and the consumer side.

1. Introduction

Tropical deforestation amounted to around 8.5 million hectares (Mha) annually in the years 2000–2012 (Hansen et al., 2013), whereas 24 Mha annually were subject to degradation between 2007 and 2012 (Tyukavina et al., 2016). Deforestation and degradation cause severe environmental impacts, among them on biological diversity and the global climate. Biodiversity impacts include population declines and escalating species extinction (e.g., Corlett 2007; Canale et al., 2012; Gibson et al., 2013) as well as impaired ecosystem functions (Fearnside 2005; Foley et al., 2005, 2007). Carbon dioxide (CO_2) emissions from deforestation and forest degradation reached 5.0 Gt per year in the period 1990–2010 and accounted for 14–21% of total global human-induced CO_2 emissions between 2000 and 2005 (Houghton, 2013; Harris et al., 2012; Grace et al., 2014).

Tropical deforestation and its impacts pose a central challenge to environmental sustainability (MEA, 2005), which is why measures for forest conservation are essential parts of several international policies,

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including the UN Conventions on Biological Diversity (CBD) and the Framework Convention on Climate Change (UNFCCC). Both were established in the early 1990s to prevent detrimental environmental impacts on the atmosphere and biosphere. However, in the face of increasing tropical forest destruction (Hansen et al., 2013), rising greenhouse gas (GHG) emission levels (Hartmann et al., 2013) and unabated loss of biodiversity (Butchart et al., 2010), the question arises whether these policies effectively tackle the drivers behind global change.

1.1. Agricultural commodities and tropical forest loss

One factor only recently receiving increased attention and thus potentially overlooked in the Conventions is the role of production and consumption of agricultural commodities in tropical deforestation. Whereas the general links between consumption in industrialized countries and tropical deforestation have been postulated for decades (e.g., Myers 1981; Hecht, 1993; Barbier, 2000), commercial agriculture has gained importance in tropical forest loss dynamics since the 1990s (Rudel et al., 2009). An increasing share of agricultural commodity production is destined for export markets, with at least 20% of the global harvested cropland area in the 2000s devoted to the production of export commodities (Kastner et al., 2014; MacDonald et al., 2015). With this, international demand for commodities like soybeans, palm oil, meat or timber has, in recent years, become a major driving force for forest conversion in the tropics (DeFries et al., 2010; Lambin and Meyfroidt 2011; Hosonuma et al., 2012). Over 40% of total tropical deforestation between 2000 and 2011 was due to the production of these four forest-risk commodities in just seven countries (Henders et al., 2015).[1]

This development can be understood as part of a general process, where globalization and a growing international commodity trade have dissolved local cause-effect chains through the spatial separation of production and consumption (Erb et al., 2009). High or growing trends of environmental impacts embodied in trade flows have been described for land use (Weinzettel et al., 2013; Yu et al., 2013), deforestation (Cuypers et al., 2013; Persson et al., 2014), GHG emissions from land-use change (Karstensen et al., 2013; Henders et al., 2015), carbon in timber flows (Kastner et al., 2011) and biodiversity (Lenzen et al., 2012; Chaudhary and Kastner 2016; Moran and Kanemoto 2017). These findings show that global consumer demand is becoming increasingly important in promoting environmental impacts in the locations where commodities are produced.

Such globalized driving factors are difficult to address with traditional policy approaches at the national or local level (Lambin et al., 2014), which typically target the producer, or supply-side of agricultural commodities through measures such as land use regulations, logging bans, or incentives for conservation. While often locally effective, these measures do not mitigate global consumer demand for agricultural commodities. If this demand increases unabated, national forest conservation policies might either be undermined by macro-economic factors (Gasparri et al., 2013), or conversion could shift to other places, creating a leakage effect (Meyfroidt et al., 2013; Henders and Ostwald 2014). Both processes carry the risk of rendering international forest conservation efforts, such as REDD+, ineffective in the long-term (Henders, 2014). Hence, forest conservation policies need not only address domestic deforestation drivers, but also react to international pressures posed by markets and consumer demand. These can be tackled by demand-side measures, which aim to create awareness and lifestyle changes in the consumers, promote demand for sustainably sourced commodities and encourage deforestation-free production along supply chains; thus indirectly influencing land use decisions (see Background section).

[1] Argentina, Bolivia, Brazil, Indonesia, Malaysia, Paraguay and Papua New Guinea.

1.2. Agricultural commodities in the UN conventions on biodiversity and climate change

Both the UNFCCC and the CBD were outcomes of the Rio Earth Summit in 1992, responding to the recognition that biodiversity loss and climate change are global challenges that require internationally coordinated responses. Although intending to address the underlying drivers of global change, commodity consumption as driver for forest loss is not mentioned in the Convention texts and their major decisions. Even general wording on sustainable production and consumption is found only in very recent documents: the Paris Agreement (UNFCCC, 2015) in a by-sentence "also recogniz…(es) that *sustainable lifestyles and patterns of consumption and production*, with developed country Parties taking the lead, *play an important role in addressing climate change*", whereas the 2020 Strategy (UNCBD, 2010) in one of 20 targets calls *for the development of plans on sustainable production and consumption to address biodiversity loss*.

In the light of this vague wording in international agreements, here we explore the research question: Do recent national biodiversity and climate change strategies developed by member states to the Conventions reflect global developments and address agricultural commodity consumption as deforestation driver?

To this end, we conducted a detailed text analysis of National Biodiversity Strategies and Action Plans (NBSAPs) submitted to the CBD, as well as Intended Nationally Determined Contributions (INDCs) submitted to the UNFCCC, up to March 2016. A total of 271 national strategies were screened for terminology around international trade, consumption, and exports to identify links between deforestation and commodity consumption. We then examined in further detail the national strategies developed by eight case countries sustaining both substantial deforestation rates and export production of agricultural forest-risk commodities: Argentina, Bolivia, Brazil, Cameroon, Indonesia, Malaysia, Papua New Guinea and Paraguay. In addition to these countries' INDCs and NBSAPs, we also analysed the national strategies developed in the context of major REDD+ initiatives, the UN-REDD programme and the World Bank's Forest Carbon Partnership Facility (FCPF).

2. Background: demand-side measures addressing commodity-driven deforestation

Several private-sector and civil-society initiatives have been developed to address the effect of agricultural commodity consumption on deforestation. Such demand-side measures can take the form of certification schemes and roundtables for sustainable production, of moratoria or legislation to restrict market access for products incurring deforestation (Walker et al., 2013), or of industry commitments to deforestation-free supply chains (Forest Trends, 2016), see Table 1.

Roundtable and/or certification schemes are voluntary governance mechanisms that are jointly developed by producers, members of the industry and civil society. Major commodity roundtables include the Roundtable on Sustainable Palm Oil (RSPO), the Roundtable on Responsible Soy (RTRS), the sugarcane roundtable (BonSucro), and the Roundtable on Sustainable Biofuels (Walker et al., 2013). Certification is a popular and widespread measure to facilitate consumer demands for sustainable commodities, and is also commonly used to show companies' adherence to *zero-deforestation pledges* (Forest Trends, 2015). A point of criticism is that it focuses on 'cleaning up' one product and its supply chain, which does not account for the fact that deforestation drivers are interlinked at landscape level – in the worst case this can lead to simply 'shifting the blame' to other crops, rather than a real reduction in deforestation rates (Mithofer et al., 2017). Another problem is related to the definitions, criteria and indicators used by some certification schemes, which not necessarily ensure an effective conservation of ecosystems (Neeff and Linhares-Juvenal 2017).

Moratoria in this context are agreements between industry players,

Table 1
Examples of demand-side measures targeting forest-risk commodities.

Demand-side measure	Examples	Commodity addressed
Voluntary certification schemes	Roundtable on Sustainable Palm Oil (RSPO)	Palm Oil
	Roundtable on Responsible Soy (RTRS)	Soy
	Forest Stewardship Council (FSC)	Timber
Moratoria	Soy Moratorium	Soy
	Cattle Agreement	Beef
	Indonesia Peat Moratorium	Timber/Palm oil
Zero deforestation pledges	Individual company commitments	Different crops and their supply chains, mostly palm oil and timber
	Consumer Goods Forum	
	Tropical Forest Alliance	
Legislation	EU Timber Agreement	
	US Lacey Act	Timber and timber products
	Australian Illegal Logging Prohibition Bill	
	EU Resolution on Palm Oil and Deforestation	Palm oil

commonly with NGOs, where retailing and processing companies commit to avoid acquiring raw material from a particular area, or from individual producers in an area that are involved in deforestation (Walker et al., 2013). Examples include the Soy and the Cattle Moratoria in Brazil (Gibbs et al., 2015, 2016) as well as the (less successful) government-induced moratorium on peatland conversion in Indonesia (Murdiyarso et al., 2011). Moratoria can be very effective at local or regional scale, but they are dependent on supportive enabling conditions, and also face the risk of displacing deforestation activities to regions where they are not active.

Under increasing pressure from consumers and investors, over 300 private-sector companies have committed to *deforestation-free supply chains,* including retailers such as Kellogg's, Ikea, Mars, L'Oréal, and Unilever, as well as agribusiness companies like Wilmar, Bunge, or Cargill (Persson et al., 2014). Whereas such zero-deforestation pledges have the potential to positively reinforce public forest conservation policies (Nepstad et al., 2014), large differences exist regarding the level of detail, timeframes, and stringency. The definitions of what actually constitutes a forest and thus deforestation, or whether to target gross or net deforestation differ greatly between industry sectors and regions of the world (Neeff and Linhares-Juvenal 2017). Moreover, no mechanism for independent verification of progress towards these pledges exists, which strongly limits the transparency of industry commitments.

These demand-side measures represent innovative and much-needed action from society and industry to address tropical deforestation from different angles, going beyond traditional policy approaches. Nevertheless, initiatives are often led by individual agents such as NGOs or corporations, and thus have limited scopes and geographical coverage, which makes them difficult to upscale. To make a lasting impact on deforestation rates, it is therefore important that demand-side action is recognized and actively supported by multilateral policies, ideally with complementary measures that are aligned to existing initiatives (Lambin et al., 2014).

One example of enabling demand-side policies is legislation to address illegal logging through import bans and strict information requirements on the origin of wood imports. Such laws have been established in the US (The Lacey Act; U.S. Fish and Wildlife Service, 2008), in Australia (The Illegal Logging Prohibition Act; Australia, 2012), and in the European Union (the European Timber Regulation from 2013; EU, 2010), where they serve as overarching, legally-binding framework that includes all other activities in the jurisdiction.

Another example is the 'Resolution on Palm oil and Deforestation of Rainforests' (EP, 2017), aiming to establish an EU-wide national commitment to reach 100% certified sustainable palm oil supplies by 2020. The resolution explicitly credits voluntary initiatives such as certification and company commitments for palm oil production, but clarifies that voluntary measures alone are not enough to ensure sustainability in palm oil supply chains and calls for binding regulation and mandatory certification. To that end, the resolution calls for the development of a new legislative act to ban sales of unsustainable palm oil in the EU; and also more broadly for EU-wide legislation on agricultural commodity supply chains, following the example of the timber regulation.

Strong legislation sends a concerted demand signal to the market, which, coming from an entire region such as the EU, might have more weight than individual consumers asking for sustainable products. A long-term legal basis also creates a predictable environment for finance and investments in sustainable commodities.

3. Materials and method

3.1. Text analysis of climate and biodiversity strategies

The objective of this quantitative analysis was to screen national climate change strategies submitted to the UNFCCC[2] and biodiversity strategies under the CBD[3] for text detailing export production, market demand and consumption as deforestation drivers. The analysis covered all INDCs and NBSAPs in English language submitted up to March 2016, which resulted in a total empirical material of 271 documents, comprised of 139 INDCs (out of 164 submissions in total) and 132 NBSAPs (out of 180 in total).

- The INDCs describe the UNFCCC member states' post-2020 mitigation targets and intended measures under the Paris Agreement, and were formulated during 2015–2016. They are among the most recent and up-to-date national programme documents under the UNFCCC. When a country has ratified the Paris Agreement, its *i*ntended national contribution (*I*NDC) is converted into a stated national contribution (NDC), and uploaded to a newly established registry. Technically, NDCs are thus the newest strategies submitted to the UNFCCC, but in practice the content of INDC and NDC documents is identical.
- The NBSAPs are national biodiversity strategies that CBD member states are required to develop under Article 6 of the Convention. They describe how the countries intend to fulfil the objectives of the Convention, considering specific national circumstances. Whereas NBSAPs were submitted from 1999 onwards, more than 100 of the 180 documents are newer than 2010.

The text analysis of these documents was conducted using the 'NVivo'software,[4] which is a state-of-the-art commercial tool for computational text analysis. Three different analyses were carried out:

(a) First, a search for the occurrence and frequency of specific terms, to identify references to deforestation due to consumption and export/trade of agricultural commodities. The search terms were*: deforestation, export, trade, commodity, consumption*.
(b) Second, we examined in which context the terms *"consumption"* and *"deforestation"* are used, and whether this suggests any relationship between forest loss and commodity consumption. A compound word frequency analysis was conducted for paragraphs surrounding these terms; meaning that in two steps we (1) extracted all

[2] http://www4.unfccc.int/submissions/indc/Submission%20Pages/submissions.aspx; accessed 3 March 2016.
[3] https://www.cbd.int/nbsap/search/default.shtml; accessed 3 March 2016.
[4] http://www.qsrinternational.com/what-is-nvivo, accessed 10 March 2016.

Table 2
Key characteristics of case countries and documents included in the analysis. Deforestation and ranking – based on tree cover loss as per Global Forest Watch (2016). RPP-Readiness Preparation Programme; ER-PIN-Emission Reduction Project Idea Note; x- document included, o: non-English documents (excluded from analysis).

Countries	Deforestation ranking 2001–2014	Deforestation (Mha), 2001–2014	Main commodities produced	INDC	NBSAP	UN-REDD	FCPF	
							RPP	ER-PIN
Brazil	1	38.34	soy, cattle	x	o			
Indonesia	2	18.5	palm oil, timber, pulp & paper	x	x	x		x
Malaysia	4	5.63	timber, palm oil	x	x	o		
Argentina	5	4.92	soy, cattle	x	o	o	x	x
Paraguay	6	4.46	soy, cattle, timber	o	o	o	x	
Bolivia	7	3.39	soy, cattle	x	o	o	x	
PNG	20	0.78	timber, rubber, palm oil	x	x	x	x	
Cameroon	23	0.66	timber, rubber, palm oil	o	x	x		x

paragraphs that contain either the term "*consumption*" or "*deforestation*", and (2) identified the words most frequently mentioned in the same paragraphs. We excluded all words with less than four characters to avoid useless results for short words like "and" and "or".

(c) Finally, we refined the analysis by identifying pairs of terms mentioned together, to explore whether any of the search words used in (a) above are used in the context of deforestation. To that end we conducted a compound analysis, in which we identified whether and how often the following two words (word pairs) occurred within the same text paragraph: *Deforestation + consumption; deforestation + trade; deforestation + commodities; deforestation + export.*

3.2. Analysis of case country strategies

In a second step, we narrowed our analysis to eight case countries: Argentina, Bolivia, Brazil, Indonesia, Malaysia, Papua New Guinea, Paraguay, and Cameroon. The first seven were case countries of an earlier assessment of deforestation emissions embodied in trade of agricultural commodities (Henders et al., 2015), because they comprise a large share of total tropical deforestation and are major producers of agricultural commodities. In 2013, Argentina, Bolivia, Brazil, and Paraguay together produced 84% and 98% of all South American beef and soy, respectively, whereas Indonesia, Malaysia and Papua New Guinea provided 86% of global palm oil production (FAOSTAT, 2016). At the same time, Brazil, Indonesia, Malaysia, Argentina, Paraguay and Bolivia were among the top-10 tropical countries with highest tree cover loss during 2000–2014 (Hansen et al., 2013; Global Forest Watch, 2016). The production of beef, soybeans, palm oil and timber in these seven countries was responsible for 40% of tropical deforestation globally and resulting carbon emissions in the period 2000–2011 (Henders et al., 2015). Cameroon as the second largest tropical timber exporter in the Central African Sub-Region (Dkamela, 2010) was added to the country list to expand the geographical coverage to Africa. The country bases its economic development plans on agricultural export production in the future (NBSAP Cameroon 2012). Both Papua New Guinea and Cameroon have had low deforestation rates in the past, but show increasing trends due to rapid development of agricultural and timber commodities. Table 2 presents for each case country the rank and area of gross tree cover loss in the period 2000–2014, the main forest-risk commodities produced and an overview of documents included in the analysis.

This more qualitative analysis considered text content in addition to the frequency and occurrence of search words, in order to investigate whether and how countries with known links between export commodity production and deforestation address the pressures from international market demand on their forests. In addition to INDCs and NBSAPs, we also analysed national strategies developed in the frame of two major international REDD+ initiatives, the UN-REDD programme[5] and the World Bank's Forest Carbon Partnership Facility[6] (FCPF). Except for Brazil, all countries participated in at least one of these programmes. The REDD+ strategy documents developed in this context include so-called Readiness Preparation Programmes (RPP) and Emission Reduction Project Idea Notes (ER-PINs) under the FCPF, and National Joint Programme documents (NJPs) under the UN-REDD initiative. RPPs and NJPs contain detailed analyses of the national forest context, including deforestation drivers and strategies to reduce deforestation, whereas ER-PINs propose specific forest conservation programmes at sub-national scale, with selected measures and specific targets. The available case country documents (Table 2) were searched with NVivo for the same search terms used in step (a) above. From there, explicit measures addressing deforestation for commodity production and export were manually identified.

4. Results

4.1. Text analysis of national climate and biodiversity strategies

(a) The 139 UNFCCC country submissions commonly refer to forest loss, with 46 INDCs discussing *deforestation*, whereas only four INDCs mention *commodities,* albeit not agricultural ones. *Export* and *trade* were mentioned in more than 20 INDCs, whereas the rather general term *consumption* was found in 87 documents (Fig. 1) and is therefore the most frequent of our search terms, used in many different contexts (Fig. 2). *Deforestation* is mentioned in 74 of the 132 biodiversity strategies, mainly as threat and pressure factor. *Commodities* are mentioned in 26 and *export* in 86 NBSAPs, whereas *trade* and *consumption* are named much more often, in 118 respectively 102 NBSAPs (Fig. 1).

(b) Across all search terms and all 271 assessed documents, *consumption, trade* and *deforestation* were the most frequently used terms, in 190, 152 and 124 documents, respectively. A possible reason is that these are rather general expressions that can be used in numerous contexts. We therefore conducted a compound word frequency analysis for the terms *deforestation* and *consumption* (see *Methods*), to identify with which terms these words are most frequently used (Fig. 2). Across all documents, *consumption* is most frequently mentioned within the same paragraph as the terms *energy* and *production*, but also together with *biodiversity* and *sustainable*. The latter is most likely because nearly all 132 NBSAPs (= roughly half of the empirical material) cite at least once the Aichi target no. 4, which links biodiversity to sustainable consumption. *Deforestation* is most frequently discussed in the context of *forest, climate, degradation*, and *biodiversity,* and in some occasions together with

[5] http://www.un-redd.org/.
[6] https://www.forestcarbonpartnership.org/.

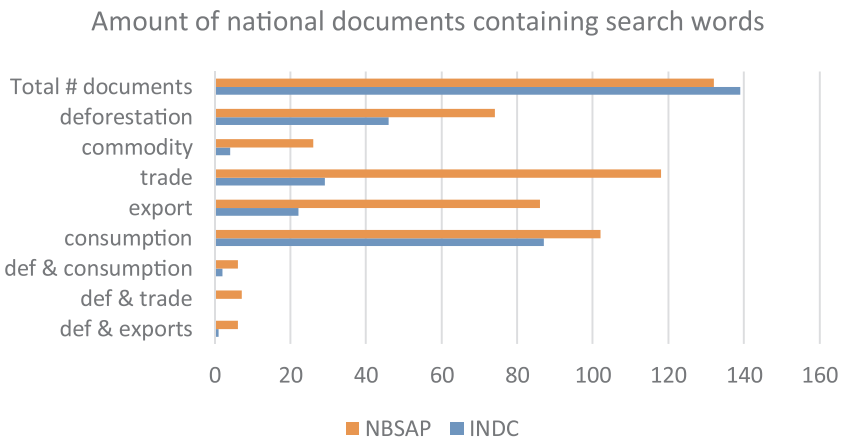

Fig. 1. Assessment of 271 national submissions (139 INDC and 132 NBSAP), answering the questions: 1. How many documents refer to the search terms? 2. How many documents contain the word combinations?

Fig. 2. Search terms consumption (2a) and deforestation (2b) and the most frequent terms found in the same paragraphs across all analysed documents. Word sizes are proportional to the frequency of used words.

agriculture, timber, logging, wood and *charcoal*, whereas terms such as *commodities, export* or *trade* are not contained.

(c) While Fig. 2 suggests that consumption and deforestation are not discussed in context of each other, a compound analysis of word pairs (defined as two words mentioned within the same paragraph, see *Methods*) allows a more targeted search for linkages between *deforestation* and the terms *consumption, trade, commodities*, and *export*. Results show that these do exist, although they are few (see also Fig. 1):

- The combination of *deforestation & consumption* was found in eight documents – two INDCs (Angola and Togo) and six NBSAPs (Cameroon, Colombia, Jamaica, Nigeria, Pakistan and Sierra Leone). Manual inspection showed that in four cases, deforestation was linked to domestic consumption of biomass, fuelwood and/or charcoal, in two cases to domestic consumption of sawn wood, timber and poles, and in two cases there was no meaningful relation between the terms.
- The combination of *deforestation & commodities* was not found in any of the documents, whereas seven biodiversity strategies mention the broader context of *deforestation & trade.* Nepal's NBSAP describes a link between deforestation and illegal trade in wildlife and timber, while two cases (Italy and Sri Lanka) were false positive results. Interestingly, the most outspoken references to deforestation and trade were found in NBSAPs of consumer countries. Austria and Belgium mention their support for REDD + and the EU Forest Law Enforcement, Governance and Trade (FLEGT) initiative, whereas Ireland aims to reduce its ecological footprint of consumption, in particular the impact of its trade on global biodiversity, by minimising imports of tropical timber, palm oil and biofuels from unsustainable sources. The Netherlands show an interest in sustainable production and consumption, and have established the Sustainable Trade Initiative, which develops sustainability criteria for global supply chains of several commodities, including soy, palm oil, cocoa, coffee, tea and biomass. Moreover, the country is engaged in establishing a Roundtable on Sustainable Timber.
- In seven cases a link between *deforestation & export* was found: Somalia's INDC describes how its natural resource base and food security is threatened by excessive charcoal production for exports, whereas the NBSAPs of Cameroon, Afghanistan, Sierra Leone and Myanmar mention legal and illegal timber exports as deforestation factors. Jamaica clearly identifies large-scale agricultural export production as key deforestation driver, while Tonga sees a general conflict between its prioritization of crop production for export and ecological sustainability.

4.2. Analysis of case country strategies (INDCs, NBSAPs, and REDD +)

This section describes the results for each case country in detail, and presents a summary overview of main findings in Table 3 below.

4.2.1. Argentina

Deforestation is not mentioned in the **INDC,** which instead emphasizes the country's role as food producer for the world market. Stating that "Food production [*in Argentina helps]* to satisfy the growing world demand, contributing to guarantee global food security" (p.4), Argentina stresses that it does not wish to see climate policies restricting international trade. The INDC contains an unconditional emission reduction goal, which also includes the "promotion of sustainable forest management". One measure to reduce emissions from

Table 3
Summary of main findings regarding agricultural commodity production as driver for deforestation in the case countries.

Country	Acknowledge driver	Address driver	Suggested measures	Reference to demand-side measures
Argentina	x	x	- ER programme targeting forest conversion for soy and livestock, through: - incentive payments - improved law enforcement - better land-use planning and governance	Sustainable commodity-certification, e.g.: Roundtable on Responsible Soybeans
Bolivia	x	Not explicitly	A general country-wide shift to sustainable agricultural production	
Brazil	x	Not explicitly	- Incentives for: - sustainable agricultural practices - restoration of degraded pastures - silvopastoral systems combining forests and livestock	INDC contains no references but several demand-led initiatives are currently being implemented, see Discussion
Cameroon	x	x	- Reduce impacts from development strategy, through: - increased productivity of agriculture systems - rehabilitation of abandoned plantations - reforestation/restoration of degraded forests - improved land-use planning	Forest certification (within FLEGT)
Indonesia	(x) Only when describing districts participating in ER programme	(x) by listing potential strategy options	- Potential activities (tbd): - Reduced Impact Logging - best management practices - support certification systems - land swaps to redirect new agricultural development to degraded areas	Mentions palm-oil certification and forest certification
Malaysia			Sustainable management of production forests and agriculture production systems	Plans to promote sustainable lifestyles and demand for environmental-friendly products
Paraguay	x	x	- Eradicate illegal activities: - better law enforcement & monitoring - de-intensified livestock production systems - Sustainable crop production	Certification of sustainable crop production envisaged
Papua New Guinea	x	x	- Reduced impact logging: - review existing agricultural leases - place new oil palm plantations on degraded areas	

the land-use sector is the 'Law on Environmental Protection of Native Forests', which introduces sustainability criteria for land-use management and allows the creation of conservation categories. The law establishes a national fund that compensates the private sector and jurisdictions for the conservation of forests.

Argentina is a member of both the UN-REDD and the FCPF programmes, but only the FCPF documents are in English. Results for the **FCPF Readiness Proposal** (2010) and the **Emission Reduction PIN** (2015) differ greatly from the above findings – both documents frequently refer to *deforestation* (159 times in the RPP, 129 times in the ER-PIN). Both documents make several references to *export* and *commodities,* describing the expansion of commodity-based agriculture, mainly for soybean and livestock production, as major deforestation drivers. In addition to policy and land-use reforms, the ER PIN proposes a programme to address commodity-driven deforestation in the north-eastern Chaco province. The programme suggests measures in three fields – (a) payments for forest conservation and sustainable forest management, (b) better law enforcement, and (c) improved land-use governance and planning. For (c), a potential alliance with initiatives for sustainable production of soybeans and other commodities is mentioned. Interesting to note is that the Emission Reduction programme is planned as carbon offset mechanism, with a major share of emission reductions to be offered to the FCPF Carbon Fund. This is probably one reason why it is not included in the INDC goals and implementation measures, to avoid double counting.

- Although not mentioned in its INDC, Argentina acknowledges the importance of agricultural export commodities as national deforestation drivers in its REDD strategy, and has developed a pilot programme to reduce commodity-based deforestation in two provinces

4.2.2. Bolivia

The **INDC** mentions *deforestation* in five places, stating ambitious targets: to eradicate illegal deforestation by 2020; to increase forest area through reforestation, to increase the contribution of sustainable agriculture to the GDP to over 5%, and to abolish extreme poverty of forest-dependent communities, all by 2030. Several implementation measures are described, including the establishment and appropriate management of protected areas, soil and forest restoration, the consolidation of agroforestry and other semi-intensive production systems, sustainable agricultural production as well as improved law enforcement and monitoring capacities to track down illegal deforestation. The terms *commodities, export* or *trade* are not mentioned in connection to deforestation.

Bolivia's **FCPF readiness plan** from 2008 mentions *deforestation* 92 times. Although it states that large scale agro-industry, mainly for soy, is behind 75% of national deforestation, the term *export* is not contained at all, whereas *commodity* and *consumption* are mentioned once each. *Trade* is mentioned once in the context of illegal timber harvesting, which is described as important forest degradation driver. One strategy suggested to address commodity production is the reduction of opportunity cost for forest conservation compared to agricultural land uses, through financial conservation incentives for small- and medium scale farmers and municipalities. An essential limitation to these results is that the document is from 2008 and therefore outdated. Bolivia has since 2010 opposed all international REDD activities and in 2012 announced a domestic alternative to REDD – the 'Joint Mitigation and Adaptation Mechanism for Holistic and Sustainable Forest Management'. This mechanism is also described in the INDC and focuses on sustainable commodity production, including fines and sanctions for non-compliance and illegal forest conversion.

- With this, Bolivia sets ambitious goals for the forest sector and relies

on a strictly domestic approach to controlling deforestation, planning a major reorientation of all agricultural and forest production towards sustainable management and de-intensified systems. Whereas commodity production for export is mentioned as important deforestation driver, no reference was found to plans explicitly addressing it

4.2.3. Brazil

Deforestation is mentioned three times in the **INDC,** first in the description of recent national successes in reducing deforestation rates, and then in relation to even more ambitious targets in the forest and land-use sector. These include, by 2030, to reduce illegal deforestation to zero, reforesting 12 Mha, and to improve the management of native forests to control illegal and unsustainable practices. Implementation is closely linked to Brazil's National Plan for Low Carbon Emissions in Agriculture, which provides incentives for sustainable agricultural practices that reduce GHG emissions and increase carbon sequestration. In addition, the INDC foresees restoration of degraded pastures, and silvopastoral systems combining forests and livestock. The search term *consumption* is mentioned only once (in the context of biofuels) whereas *export, trade* or *commodities* are not discussed at all.

Brazil does not participate in any of the two REDD+ initiatives, therefore no further documents could be included in the analysis. Concluding from only one analysed document, it might seem that Brazil remains silent on the role of commodity production in forest destruction. However, the country has successfully decreased forest loss in the Amazon in recent years, thanks to a whole basket of different strategies and mechanisms (Boucher et al., 2013; Nepstad et al., 2014). In addition to revised legislation and stricter law enforcement, these include moratoria on soy and cattle from cleared areas in the Amazon (Gibbs et al., 2015, 2016) as well as subnational REDD programmes (Duchelle et al., 2014).

- *Brazil does not mention deforestation and the role of export production in its INDC, but has been successful in reducing deforestation through a combination of supply-side policies and demand-side measures, which is discussed in more detail below (Discussion).*

4.2.4. Cameroon

The **NBSAP** extensively discusses *deforestation* (31 references), both in connection to timber *exports* (mentioned twice) and to unsustainable *consumption* of fuelwood (used once). *Trade* is mentioned 16 times, though mostly in connection to illegal wildlife, whereas *commodities* are described as underlying the future development of the national economy. Cameroon's **Emission Reduction PIN** focuses on the terms *deforestation* (122 references) whereas *consumption* is mentioned ten times – although not in the context of deforestation, as manual inspection showed. *Commodities* (three references) and *trade* (seven references) are mentioned much less frequently. This can be explained by Cameroon's general approach to development and commodity production: the overarching national development goal is to transform the economy and become an emergent country by 2035. This goal is to be reached partly through an extensive program of increasing and modernising agricultural production to supply agro-industries, in addition to meeting domestic food demands. Deforestation rates are expected to increase as a side-effect of this strategy, but the document clearly supports the prioritization of development. The programme suggested in the PIN therefore focuses on reducing the expected negative impacts on forests, with measures such as increased productivity of agriculture systems, rehabilitation of abandoned plantations, restoration of degraded forests and reforestation, and improved land-use planning "to reduce impacts on forest from the establishment of agricultural plantations, from mining and infrastructure development" (p. 17). In addition, reduced impact logging and the promotion of forest certification in the context of the EU FLEGT initiative are suggested as sustainable forest management measures.

- *Cameroon is explicit on its prioritization of economic development, to be based on agricultural production. Its REDD+ strategy focuses on reducing negative impacts from this strategy on forests.*

4.2.5. Indonesia

The **INDC** contains three references to the terms *deforestation* and *consumption,* respectively, whereas *commodities* are mentioned once. No reference is made to *export* and *trade*. However, as over 60% of Indonesia's total emissions come from the land-use sector, the overall objective of sustainable natural-resource management is mentioned several times throughout the document. The moratorium on the clearing of primary forests and the conversion of peatlands (see *background section*) is mentioned as ongoing effort, whereas future measures to protect and conserve existing forests remain rather vague. The INDC emphasizes the national priority to promote economic development in order to reduce the poverty rate to below 4% by 2025.

The **NBSAP** from 2003 shows more references to the search words, mentioning *deforestation* ten times, *export* and *commodities* five times each, and *consumption* six times. However, the document in general seems to be outdated, with all objectives set in relation to forests and wetlands not achieved by 2016.

Although the **National REDD+ Strategy** from 2012 talks extensively about REDD, *deforestation* is mentioned only six times and *trade* twice (in the context of carbon trade, and efficient trade chains). *Export, consumption* and *commodities* are not mentioned. The main aim of the strategy is to create an environment for effective implementation of REDD+, demanding a major transformation of the land-governance system. Weak institutions and poor governance are identified as underlying drivers of forest conversion and will be addressed through a complete 'system-reset' with "new institutions, regulations, mechanisms, relationships and governance systems" (p. 40). Intended activities therefore focus on legal and regulatory reforms, and the development of an institutional framework.

Indonesia's **Emission Reduction PIN** from 2016 focuses on *deforestation* (52 references), whereas *trade* is mentioned four times, twice referring to the CITES agreement and twice to the WWF Global Forest Trade Network. The terms *export, commodities* and *consumption* are not contained. This reflects the strategic orientation of the proposed subnational REDD+ programme, which will operate at the institutional level and will generate lessons learned from the implementation of measures in case districts. The programme will contribute to national forest governance and spatial planning reforms, support the establishment of decentralized management units and address tenure issues. Detailed field measures have not yet been determined, but ideas include support for community-based forest management, alternative livelihoods, yield improvements, and capacity building. Activities directed at forest concessions and crop plantations include capacity building for Reduced Impact Logging, support for certification systems, and best management practices. The PIN also acknowledges that in some cases economic incentives for deforestation can outweigh the incentives from REDD+ payments. Whereas illegal conversion will be prosecuted, in cases where forest clearing is legal and REDD+ incentives are not high enough to prevent this, the plan foresees land-swapping options to expand agriculture to degraded areas instead of forests.

- Indonesia's documents focus on weak governance as underlying deforestation driver, and REDD+ measures are designed accordingly to reform the country's land governance system. The role of commodity production in driving forest conversion is not mentioned, except for a subsection of the Emission Reduction PIN that discusses deforestation drivers for some of the pilot districts. The proposed activities in the programme focus on institutional and policy levels, whereas some tentative measures to address commodity-induced deforestation are named as examples of **potential** activities that **could** be implemented.

4.2.6. Malaysia

The **INDC** makes no reference to most of our search words, except for *consumption*, which is used twice in the context of sustainable consumption and production. Forests in general are mentioned in the description of the Tenth Malaysia Plan (national development strategy 2011–2015), which includes two initiatives for sustainable forest management.

The latest **NBSAP** from 2016 is much more explicit on the search terms. Although *deforestation* is not mentioned, the term *export* is found twice, describing a seven-fold increase in Malaysia's export volumes. It is recognized that Malaysia's rapid economic growth accelerates *consumption* levels in the country, bringing along fierce land competition and challenges for biodiversity conservation. *Commodities* are explicitly mentioned among the policies in need of review, besides agriculture, timber, and extractive industry policies; and also in the aim to increase food production and commodities on existing agricultural land. Of the 17 national biodiversity targets, Target 4 includes sustainable management of production forests and agriculture production systems, whereas Target 6 foresees protected areas and other area-based conservation measures on at least 20% of terrestrial areas and inland waters. The need for lifestyle changes and better resource management is acknowledged, including an action point on "promoting sustainable lifestyles to encourage the demand for green/environment-friendly products" (p. 50). With this, the NBSAP is both Malaysia's most explicit and most recent document on this topic. The country does not participate in the FCPF, but has joined the UN-REDD programme with an observer status, meaning it does not have to submit REDD documentation.

- *Malaysia's NBSAP does not explicitly mention commodity production in connection to forest loss, nor devise any measures to address it. Instead, it states the objective to shift to sustainable agriculture and forest production until 2025, together with an earlier pledge to maintain forest cover above 50%. At the same time, the country's remaining forest resources in Borneo are subject to intensive logging and conversion to oil palm plantations* (Gaveau et al., 2014)*; developments that are not mentioned in the document.*

4.2.7. Paraguay

Our analysis covered only the REDD+ **Readiness Proposal** submitted to the FCPF in 2014, since Paraguay submitted all other strategies in Spanish. The RPP provides a comprehensive description and analysis of the national conditions. *Deforestation* is mentioned 135 times, and *exports* of timber and agricultural products (mentioned 10 times) are described as important for the national economy, with around 50% of exports comprised by soy and beef commodities. The term *commodities* is found eight times, in relation to markets, products and exports, whereas *trade* is mentioned in six places, referring to forest products, carbon credits and globalization. Eleven references are made to *consumption*, in relation to water, energy, biomass and firewood, as well as food production for domestic consumption and unsustainable timber consumption. The RPP acknowledges that the steep economic growth expected for the near future will result in increased consumption, contributing to GHG emissions. Several strategic options are presented to reduce deforestation and implement a national REDD+ programme, including enhancing natural-resource governance through an improved forest-monitoring system combined with better law enforcement, and the development of technical, legislative, and financial instruments for the forest sector. The implementation of these plans will be supported by the alignment and review of legislation to facilitate zoning and land-use planning, together with the development of control measures (taxes, regulations etc.).

Activities on the ground include stimulating forest conservation through economic and financial incentives; reforestation and establishment of firewood plantations to reduce forest degradation, and to address deforestation for commodity production. Main strategies here are to improve law compliance and enforcement of agriculture and forest regulations to reduce illegal activities, to strengthen protected areas, to provide incentives for best management practices in and certification of agriculture and livestock production, to support subsistence farmers and agroforestry systems, and to develop schemes for de-intensification of livestock production in silvopastoral systems.

- *With this, Paraguay names commodity production as underlying the national economy, and identifies a major challenge in reconciling economic development with the preservation and recovery of forests. Several strategies are suggested to specifically address deforestation for commodity production.*

4.2.8. Papua New Guinea (PNG)

The **INDC** contains four references to *deforestation* and talks extensively about REDD+, reflecting that the national mitigation action concentrates on the land-use sector, which incurs 95% of the national emissions. Suggested activities focus on promoting sustainable forest management and forest conservation, with reference to the country's emerging REDD+ strategy. However, concrete measures have not yet been defined as data collection and land-use change assessments are ongoing. The INDC makes clear though that the implementation of REDD+ measures as well as data collection require extensive capacity building, technology transfer and technical assistance. The term *consumption* is mentioned once in connection to energy, whereas the other search terms were not mentioned.

The **NBSAP** from 2007 twice mentions an initiative to reduce deforestation as strategy to access global carbon markets (not called REDD + here as the term was coined only in December 2007); however, no further details are given. The term *trade* is used three times, referring to fair trade, illegal species trade, and monitoring of illegal trade, whereas *export* is mentioned once in the context of genetic resources.

PNG is a member of UN-REDD since 2011 and joined the FCPF in 2013. The combined **RPP-NPJ** document submitted to the FCPF in 2013 makes 61 references to *deforestation,* whereas *export* is mentioned five times, mainly in the context of logs, timber and forestry products. *Trade* is found five times, *inter alia* describing the EU FLEGT initiative, but *consumption* and *commodities* are not mentioned. Suggested policy measures include agricultural extension programmes to increase production on existing agricultural land, enrichment planting of logged-over forests, reforestation of marginal lands, and a national fire management programme. Deforestation for export commodity production will be reduced by introducing reduced impact logging, reviewing existing agricultural leases on 670,000 ha to minimise natural forest conversion for agricultural expansion, and redirecting new oil palm plantations to degraded areas. The assumption for the latter is that by 2015, around half of new oil palm plantations will be established on former agricultural lease areas, with the rest established on degraded lands. In the context of these measures, the document emphasizes the need to carefully balance REDD+ opportunities with economic development considerations.

It is recognized that the implementation of REDD+ measures requires a major reform to strengthen overall governance of natural resources, including a revision of land-use legislation, regulations and policies as well as their enforcement. The document states that the "effective implementation of REDD+ initiatives will require political will and a shift in priorities by the national government away from development through reliance on large-scale industrial logging and agricultural monocultures in lowland forests" (p. 47). In this context, identified implementation challenges include "the lack of funding and support from the national government" as well as "corruption in the government that makes it very difficult to implement policies or measures for addressing drivers of deforestation and forest degradation".

- *PNG clearly acknowledges the role of export commodity production in driving deforestation, and suggests several strategies how this driver could*

be addressed. Whereas the stated objectives especially for new oil palm plantations are ambitious, the analysed documents acknowledge that existing governance challenges might hamper the implementation of intended measures.

5. Discussion and conclusion

The results show that a general link between unsustainable consumption levels and the degradation of the planet is recognized by both UN Conventions. However, explicit links between forest loss and agricultural commodities are contained in only 14 of the 271 national strategies analysed, including five documents identifying domestic wood consumption as deforestation factor, and seven documents detailing forest loss related to exports. Two biodiversity strategies mention activities addressing the demand side, namely sustainable commodity consumption and supply chain initiatives.

Overall, biodiversity strategies include much clearer references to the role of consumption in the degradation of natural resources than climate change strategies. This difference stems from the fact that most NBSAPs follow a template, which includes a discussion of underlying drivers for biodiversity loss. In contrast, the INDCs are short and concise documents, describing concrete intended emission-reduction actions rather than discussing emission drivers. Despite this difference, the policy measures suggested to protect forests in both document types do not address commodity-driven deforestation. Considering the sharpening conflict between agricultural commodity production and the preservation of forests, this nearly complete lack of references to a key deforestation driver raises concerns for the prospect of the Conventions' effectiveness in halting environmental degradation.

However, it seems that the absence of this topic from national CBD and UNFCCC strategies does not necessarily mean that countries are not engaging in activities to reduce commodity-based deforestation. The REDD + strategies of our eight case countries address links between export commodity production and national deforestation to a very different degree: Whereas Argentina and Paraguay name commodity-driven deforestation as problem and present strategies to address it, Bolivia acknowledges the importance of the driver but does not devise specific measures for its reduction. Indonesia and Malaysia are more reserved on the topic, with Indonesia concentrating on institutional governance reforms and Malaysia emphasizing the general need for lifestyle changes to reduce resource degradation. Both countries have boosted their economic development by supplying agricultural commodities to the global market, and further growth of the palm oil industry will most likely lead to continued deforestation. Cameroon openly declares economic development as the national priority, but plans to mitigate impacts from expanding agricultural production on forests. Papua New Guinea identifies commodity production as driver but also focuses on national growth; whereas tentative measures are named to address commodity-induced deforestation, at the same time it is questioned whether these can be successfully implemented, considering the lack of political will in the country.

We showed that detailed strategies to address commodity-based deforestation, if they exist at all, are hardly referenced in the INDC and NBSAP documents, not even in countries where land-use changes constitute a major share of the national emissions budget and/or a key threat to biodiversity. It seems that UNFCCC and CBD are not seen as an appropriate forum to communicate these approaches. This becomes clear in the case of Brazil, where only the INDC was included in our analysis, and our results are strongly misleading as to the prioritization of efforts to combat deforestation in the country:

- Brazil has not joined any of the multilateral REDD initiatives, instead it has developed a national approach to reducing deforestation that successfully cut forest conversion rates in the Amazon by 80% between 2004 and 2014, despite increasing world market prices for soy and beef (Nepstad et al., 2014). A combination of public policies, improved law enforcement and innovative sustainability initiatives has contributed to this success, bringing together action by the government, the private sector and civil society (Boucher et al., 2013). Traditional policy approaches under the national "Plan for the Protection and Control of Deforestation in the Amazon" included enhancing and better managing the network of protected areas, improving forest monitoring through a real-time deforestation detection system, and the prioritization of law enforcement by the federal police. A second strategy focused on financial measures, including both positive incentives through farm-level credits for deforestation-free production systems, and disincentives in form of the 'Critical Counties' program, which suspended access to agricultural credit for farms in high-deforestation counties (Nepstad et al., 2014). The civil society provided a third line of action with campaigns and reports from environmental NGOs, eventually leading to industry commitments. A Greenpeace-report in 2006 put increasing pressure on the soy industry that was expanding into the Amazon. This resulted in the Soy Moratorium established by a majority of the buyers of Amazon soybeans, who declared not to buy soy from land cleared after July 2006. This was followed by a similar moratorium on cattle in 2009, when after two NGO reports about the deforestation footprint of Amazonian beef the region's major beef processors announced a boycott of cattle from ranches that involved deforestation. Whereas it is difficult to quantify the specific contributions of the individual measures to the overall reduction of deforestation, recent evaluation reports confirm the effectiveness of both moratoria (Gibbs et al. (2015) for the Soy Moratorium; Gibbs et al. (2016) for cattle). In addition to the efforts to decrease Amazon deforestation rates, there are other initiatives aiming to make production processes in Brazil more sustainable. Examples include the Roundtable on Sustainable Soy, which was founded by companies active in soy production and trade, as well as the cattle standard by the Sustainable Agriculture Network.

Brazil's example shows the usefulness of combining traditional supply-side policies and demand-side measures in effectively reducing deforestation. All our case countries suggest traditional policy strategies, addressing national deforestation through command-and-control measures (e.g., protected areas or land-use restrictions) or incentive payments for forest conservation. Institutional reforms such as the alignment of contradicting sectoral policies or the review of legislation affecting enabling conditions also constitute traditional policy approaches. Whereas Bolivia, Indonesia and Malaysia almost exclusively rely on these approaches, Argentina and Paraguay have recognized the need for engaging with demand-side initiatives in their strategies to address commodity-driven deforestation. Argentina mentions potential alliances with the Roundtable of Responsible Soybeans and initiatives such as the Consumer Goods Forum, and Paraguay more generally intends to promote sustainability certification of crop production. Indonesia and Cameroon both mention certification of sustainable forest management in the context of their partnership agreements with the European FLEGT initiative to reduce illegal timber exports. The results thus show that some of our case countries in fact aim to link traditional policy measures and new demand-side approaches. However, current demand-side measures are limited in scope, space and time, so that broader policy support is needed to upscale them. A main task is here to align demand-side measures and public policies, so that they are complementary and can actually increase the effectiveness of forest conservation efforts (Lambin et al., 2014; Nepstad et al. 2014).

Successful examples of public demand-side policies include international legislation on illegal timber imports (U.S. Fish and Wildlife Service, 2008; EU, 2010; Australia, 2012) and the EU resolution on palm oil and deforestation of rainforests (EP, 2017). In addition, several public-private initiatives have emerged in recent years that provide government support to private sector targets to reduce commodity-driven deforestation, thus establishing broad alliances among forest

stakeholders. The *New York Declaration on Forests* was signed 2014 by 190 parties, including governments, multinational companies, indigenous groups and NGOs, intending to halve the rate of natural forest loss by 2020 and to end it by 2030. One of the objectives is to support "the private-sector goal of eliminating deforestation from the production of agricultural commodities such as palm oil, soy, paper and beef products by no later than 2020" (NYDF 2014:1). The NYDF builds on previous initiatives such as the Tropical Forest Alliance 2020 and the Consumer Goods Forum, and is aligned with objectives of the CBD Aichi Targets. Several EU country governments endorsed two Amsterdam Declarations; one 'Towards Eliminating Deforestation from Agricultural Commodity Chains with European Countries' and the other 'In Support of a Fully Sustainable Palm Oil Supply Chain by 2020' (Amsterdam Declaration, 2015a, 2015b).

It is a major sustainability challenge to preserve forests, their biodiversity as well as crucial ecosystem services such as carbon storage potential, whilst increasing food production to feed a growing world population. As this underlying challenge is faced by all forest conservation efforts, we argue that major international policies such as the UNFCCC and CBD should actively support and devise policies that encourage sustainable, deforestation-free production on the ground, as well as measures that increase consumers' awareness and demand for sustainable commodities (as showcased in the NBSAPs from Ireland and the Netherlands).

National climate and biodiversity strategies should be aware of and envisage collaborating with demand-side initiatives such as certification schemes, roundtables, and especially policy schemes restricting imports of unsustainable products (e.g., FLEGT), to complement the basket of strategies to effectively reduce tropical deforestation. Policies and strategies should also actively target the promotion of alternatives to consumption that triggers tropical deforestation.

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