UNFCCC ACCOUNTING FOR FORESTS

What's in and what's out of NDCs and REDD+

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POLICY BRIEF

UNFCCC Accounting for Forests:

What's in and what's out of NDCs and REDD+

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Contents

1. Introduction 3
2. Nationally Determined Contributions 5
a. Comprehensiveness of forest emissions and removals in NDCs 6
b. Transparency in accounting 9
c. Other issues 12
d. Conclusions 12
3. REDD+ 12
a. What's covered in FREL/FRLs? 13
b. Conclusions 14

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1. Introduction

Within the UNFCCC, a distinction is made between national GHG reporting and GHG accounting. The former relates to information on estimates of national GHG emissions and removals through National Communications, national GHG inventories (GHGIs), and biennial reports or update reports (BRs or BURs). By contrast, national accounting refers to quantification of whether, and how, a country achieved a quantitative commitment, or how it performs against a pre-established baseline. Under Kyoto, such commitments were known as the Quantified Emission Limitation or Reduction Objectives (QELROs). Under REDD+, performance may be measured against a "forest reference emission level or forest reference level" (FREL/FRL). And the Paris Agreement, Article 4, states that "Parties shall account for their Nationally Determined Contributions (NDC)".

National GHGIs are intended to contain *anthropogenic* emissions and removals only, since they provide the bases for measuring countries' contributions to GHG mitigation. They also are an important basis to track progress for the successive stocktaking under the Paris Agreement. The IPCC provides principles and methodological guidance for estimating anthropogenic emissions and removals using the *managed land proxy,* which results in estimating only those emissions and removals occurring on lands designated by countries as "managed". The proxy was introduced to overcome the challenge of providing practical methodology to separate anthropogenic from non-anthropogenic fluxes.

National GHG inventories report anthropogenic emissions and removals only. As such, they provide the bases for measuring countries' mitigation efforts.

Mitigation contributions of Parties (included in NDCs) will be accounted in the context of the Paris Agreement and are expected to be based on GHGI reporting.

Although the development of rules and modalities for the Paris Agreement is still in early phases of development, accounting for the achievement of NDCs is expected to be based on national GHGI reporting. According to the Paris Agreement[1], developed countries should take economy-wide absolute emission reduction targets. Such Parties are expected to base accounting of their economy-wide contribution on their full GHGI estimates. Developing countries are encouraged to move over time towards economy-wide contributions. Therefore, such Parties may opt to start by only accounting for a portion of GHGs included in the inventory in their first NDC and increase inclusion in futures NDCs. Some developing country have taken this option, only including a subset of GHG emissions and removals in their initial NDC. Least developed countries and small island developing states may communicate "strategies, plans and actions" in lieu of a quantified contribution. Section 2 below provides more detail on how forests, in particular, are included in NDCs.

REDD+ reference levels (FREL/FRLs) and a Technical Annex in the BUR, where "REDD+ results" (against the reference level) are reported, aim to quantify forest-related mitigation performance in developing countries. Most countries state that these reports are for the purpose of accessing results-based payments. Countries select which REDD+ activities they want to include in their reference level, which also determines the scope of their results reporting. While COP decisions state that countries should use the latest IPCC Guidance and Guidelines and be consistent with national GHGI reporting while estimating its emissions and removals associated with REDD+ activities, in practice FREL/FRLs (and thus results reporting) often are not directly comparable

REDD+ reference levels are submitted "in the context of results-based finance" and should be consistent with GHGIs.

[1] The references to the Paris Agreement in this paragraph can be found in Article 4, paragraph 4 and 6.

and a subset of data provided in the GHGI, in some cases still using the 1996 IPCC GLs. Section 3 provides further detail on REDD+ accounting.

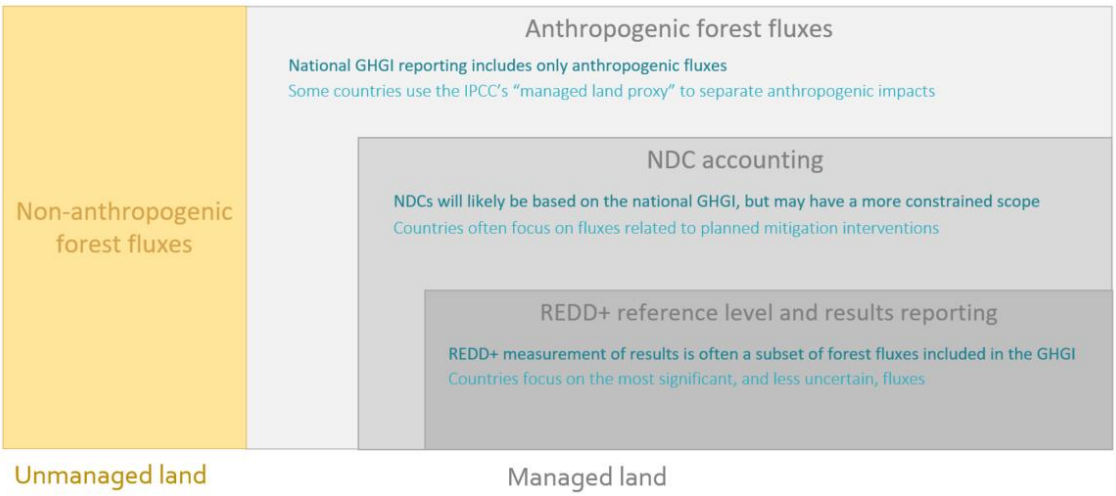
Therefore, while GHGI reporting and NDC accounting, should aim to include all significant anthropogenic emissions and removals (or justify why there are omissions)[2], in practice this may not always occur. Similarly, while REDD+ should include significant forest fluxes, this also does not always occur (see Section 3 for further explanations).

Table 1: GHG fluxes included in UNFCCC reporting versus accounting

		Scope of fluxes	Purpose	Limitations, in practice
UNFCCC Reporting	GHGI	Anthropogenic emissions/removals	Provide national (and global aggregate) overview of GHG emissions and removals and allow an assessment of measures taken by Parties	National capacities or lack of scientific methods may limit full reporting
UNFCCC Accounting	NDCs	Anthropogenic emissions/removals	Provide clear understanding of climate change action by countries, build mutual trust and confidence, and promote effective implementation	In addition to limitations above for GHGIs, many NDC are unclear as to the comprehensiveness or accounting methods that will be used for the land sector
	REDD+	Significant anthropogenic forest-related emissions/removals	REDD+ is only for developing countries; most submissions state the FREL/FRL is "in the context of accessing results-based payments"; many also mention REDD+ in their NDCs	Countries often choose only the most significant emissions (e.g. from deforestation, excluding degradation, regrowth); currently not all are national in coverage

Not surprisingly, the scope of coverage narrows—in large part due to the different purposes—as countries move from national GHGI reporting to accounting for achievement of their national targets (NDCs), and further down for accounting for REDD+ results-based payments. The image below depicts this "funneling" effect.

Figure 1: Scope of coverage of forest-related fluxes in GHGIs, NDCs and REDD+ reference levels



[2] Decision 1/CP.21 paragraph 31(c),(d) states that "*Parties strive to include all categories of anthropogenic emissions or removals in their NDC… [and] provide an explanation of why any categories… are excluded.*"

2. Nationally Determined Contributions

The Paris agreement states that all countries are "to undertake and communicate ambitious efforts" to contribute holding the increase in global average temperature below 2°C (and to pursue efforts to limit the increase to 1.5°C) above pre-industrial levels. As of June 2017, 148 countries have ratified the Paris Agreement and 142 have submitted their first NDC.

As of early September 2017[3], of the top 50 forested countries (by area, based on FAO 2015), 40 have ratified the Paris Agreement. Forest area is important since most forests continue to sequester carbon, i.e. forests remove around one-third of global GHG emissions. Of the 10 forest countries (among the top 50 by area) that have not yet ratified the Paris Agreement, Russia is the most important and, in total, there are at least 838 million ha of forests that are not currently accounted in, or "covered" by, NDCs. Forests are also an important source of emissions (from deforestation). Among the top 50 countries by net forest loss, 12 have not yet ratified the Paris Agreement—leaving over 1 $GtCO_2$ currently "outside" of potential country contributions.

Table 2: Countries that have not ratified the Paris Agreement among the top 50 countries by forest area and emissions from deforestation

Countries that have not ratified the PA	Forest Area* (million hectares)
Russian Federation	522.4
Colombia	58.5
Angola	57.9
Venezuela	46.7
Tanzania	46.1
Mozambique	37.9
Myanmar	29.0
Suriname	15.3
Ecuador	12.5
Turkey	11.7
TOTAL	838 million ha

Countries that have not ratified the PA	Emissions from net forest change* ($MtCO_2eq/yr$)
Tanzania	237.0
Dem. Rep. of the Congo	197.5
Myanmar	173.6
Venezuela	118.4
Zimbabwe	67.3
Ecuador	58.4
Mozambique	55.7
Angola	45.9
Colombia	30.0
Russian Federation	29.6
Liberia	20.0
South Sudan	17.6
TOTAL	1,051 $MtCO_2$

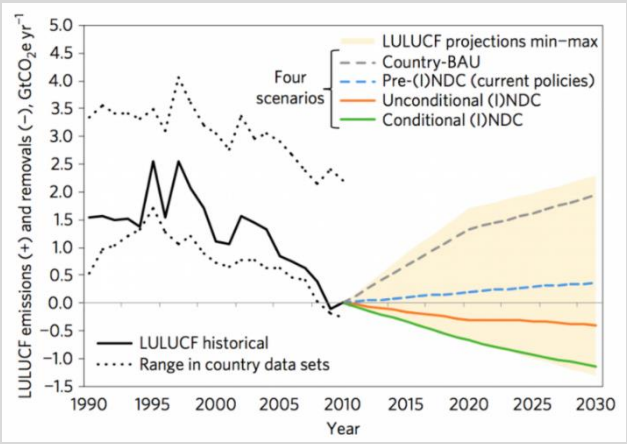
**Based on 2015 FAO Forest Resources Assessment, emissions estimates derived from FRA country reports*

Many NDCs do not specify how a country intends forest-related actions to contribute to the NDC, but rather cite a quantified economy-wide contribution; very few countries include descriptions of sectoral-specific contributions (and are not required to do so). Exceptions include a few countries with stated deforestation objectives (e.g. Brazil, Mexico) and a larger number that cited national goals for reforestation. Reforestation goals (with exception to Angola and India) are often not expressed in tons of CO_2 removals, but rather in terms of expected number of hectares of forest to be restored or other proxy measures (see Table 4). In some cases, the proportion of the NDC pledge a country intends to meet through actions in the forest sector can be derived (applying assumptions and using global data sets), or may have been provided by countries through other information (e.g. in their National Communications, or official country presentation during a UNFCCC session).

[3] This paper was originally published in July, but updated on Sept 6, 2017.

While NDCs provide a broad range of contributions to reducing emissions and enhancing sinks, the objective of this section is to indicate where there may still be differences regarding NDCs and comprehensive GHG fluxes from forests. In other words: **What forest-related emissions and removals are included in NDCs and which are excluded?** It does not seek to quantify the contributions and compare this with scientific studies that suggest the mitigation potential of the land sector. This has been done by Grassi et al (see box) for the land use sector, which is largely comprised of forest-related emissions and removals using a range of information and a number of assumptions.

Quantifying the Contribution of the Land Use sector to the Paris Climate Agreement



"The key role of forests in meeting climate targets requires science for credible mitigation" (Grassi et al, 2017)[4] highlights a high uncertainty on both the historical levels and the projections of LULUCF emissions and removals. Nevertheless, the analysis shows that countries, in the context of their NDCs, expect a significant mitigation contribution from land use, with a clear focus on forests. Assuming full implementation of NDCs, and making in some cases assumptions about how land use will contribute to economy-wide quantified contributions, LULUCF turns globally from a net source for the period 2000-2010 to a net sink of carbon in 2030, and by then is expected to provide about a quarter of planned net emission reductions.

2.1. Comprehensiveness of forest emissions and removals in NDCs

Countries with forest-related emissions generally state that their NDC includes such emissions in the scope of their NDC target. All developed countries and most emerging economies (e.g. Brazil, Mexico) indicate NDCs are comprehensive, covering all sectors, pools and gases and that their target applies to all emissions and removals covered in their GHG inventories. This implies that all their anthropogenic forest-related fluxes would be covered in the NDC. Most other developing countries that are major forest countries (by area or loss) appear to include the forest sector in their NDC, although some are not explicit on how they do so.

Therefore, the intent communicated in most NDCs is coverage of all anthropogenic forest-related emissions and removals. However, in practice some countries may face difficulties in estimating and reporting them. In particular, this is true for some developing countries, where the coverage of activities, pools, and gases is still not comprehensive in their GHGI. Some examples of large forested developing countries that lack comprehensive data in their GHG inventory are illustrated below.

[4] Grassi G., House J., Dentener F., Federici S., den Elzen M., Penman J. (2017) The key role of forests in meeting climate targets requires science for credible mitigation, *Nature Climate Change*, in press.

Table 3: Coverage of forest-related fluxes in selected national GHG inventories

Parentheses denotes a category, pool or gas that is only partially covered

	Categories			Pools						Gases	
	F>NF	F>F	NF>F	AGB	BGB	DW	L	Soil	HWP[5]	CO_2	non-CO_2
Brazil (NC, 2016)	√	√	√	√	√	√	√	(√)		√	
China (BUR, 2017)	√	√	√	√	√	√	√			√	√
DRC (NC, 2015)	√	√	√	√				√		√	√
India (BUR, 2016)	√	√	√	√	√	√	√	√		√	√
Indonesia (BUR, 2016)	√	(√)	√	√						√	(√)

There are several countries that have stated in their NDC that only specific sectors are selected for consideration. For example, Bangladesh and Fiji omit forestry in their quantified NDC (as do Nigeria and Liberia in their INDC). A few suggest that a decision will be made later whether to include forests (e.g. Belarus, Republic of Korea, Thailand). And some omit particular forest-related activities (e.g. India specifies a target for increasing removals but does not mention deforestation or forest degradation).

For the most part, however, the most critical countries—in terms of forest loss and potential forest gain—have signaled intent to include emissions and removals from forests in the accounting of their NDC. A couple countries have specified forest sector targets that relate to emissions: Brazil suggests zero net Amazon forest emissions by 2030; and Mexico suggests zero deforestation by 2030 (which would result in no emissions in the F→NF category). A number of countries also specified forest restoration targets, although not nearly to the level studies suggest are their "restoration opportunity"[6].

Overall, more specificity is needed to understand the actual coverage and whether this may change as countries improve data and, for example, add new categories, pools, or gases to their GHGI.

Table 4: Coverage of forest-related emissions in NDCs by key countries

Top 10 non-LDC countries by emission from forest loss *Ranking using FAO FRA data (emissions from forest loss in $MtCO_2$, 2015), Least Developed Countries are not included as they are not required to put forward quantified, unconditional contributions*	
Brazil (5003)	Economy-wide target according to NDC; Brazil has a relatively comprehensive GHGI (see Table 3 above)
Indonesia (363)	Forests including peat fires are included in the baseline assumptions; however, Indonesia's currently inventory is not comprehensive and there are large uncertainties around peat fire estimates
Nigeria (188)	Has not ratified Paris Agreement, although its Intended NDC (INDC) suggests that forests would be included
Tanzania (165)	Has not ratified Paris Agreement, although its INDC suggests that forests would be included

[5] HWP considered a pool in the IPCC's 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol (for the second commitment period of the KP).

[6] Data from the Atlas of Forest and Landscape Restoration Opportunities, found at: http://www.wri.org/resources/maps/atlas-forest-and-landscape-restoration-opportunities, was used to identify the top 20 countries for forest and landscape restoration opportunities. Area that most closely approximates the forest restoration opportunity were calculated by combining estimates for: (a) wide-scale restoration (potential to support closed forest); (b) mosaic restoration; and (c) remote restoration, but not croplands with intensive human pressure (over 100 people per square kilometer).

Paraguay (147)	NDC suggests all sectors in IPCC guidelines would be covered; however, its most recent national GHG (included in its 1st BUR) forest-related emissions are in an Annex, not in the main report
Argentina (122)	Sectors covered in NDC include "land use change"; more information is required to know if the full set of forest-related categories is included.
Cameroon (110)	Forests are included as a covered sector, although the first NDC does not provide quantified data for land use but rather suggests further analysis is needed, and that the sector would be integrated into the quantified target thereafter (by 2020).
Bolivia (84)	Bolivia put forward a joint mitigation and adaptation pledge; on forests its pledge states zero illegal deforestation by 2020 and an increase in forest area (which suggests net forest gain rather than loss, although the NDC is conflicting in the actual quantity of increased forest area)
Peru (84)	NDC suggests coverage is what was included in the 2010 national GHGI, which included removals from forests (biomass) and emissions from forest converted to pasture; it is unclear if this will be updated with new data—in 2016, for example, Peru submitted a 3rd National Communications with additional forest-related categories (e.g. abandoned agricultural lands, soil, and non-CO2 gases)
Venezuela (72)	Has signed, but not ratified (or accepted or approved) the Paris Agreement

Table 5: Coverage of afforestation and reforestation, or forest removals, in NDCs by key countries

Top 10 countries by forest and landscape restoration opportunities *IUCN country ranking by forest restoration opportunity (M ha)*	
Brazil (314.3)	By 2030: restore 12M ha of forest and 15M ha of degraded pastureland, and enhance 5M ha of integrated cropland-livestock-forestry systems
Russia (240.9)	NDC states that forest management is "one of the most important elements of the Russian policy to reduce GHG emissions"; NDC implies gross-net accounting for forest sink
China (175.3)	Increase forest stock volume by 4.5 billion cubic meters on the 2005 level
United States (140.6)	Comprehensive accounting implies A/R included
Canada (104.8)	Comprehensive accounting implies A/R included
Australia (97.7)	Comprehensive accounting implies A/R included
DRC (85.1)	Estimated 3M ha afforestation by 2025
India (71.9)	Create an additional carbon sink of 2.5 to 3 GtCO2e through additional forest and tree cover by 2030; long-term goal is to bring 33% of land under forest cover (currently 24%) (Bonn Challenge = 13M ha)
Angola (65.4)	Increase carbon sequestration from 3M (in 2005) to 5M tCO2eq/yr by 2030
Tanzania (58.9)	Has not ratified Paris Agreement, although its INDC suggests mitigation actions include "strengthening national wide tree planting programs and initiatives" and "enhancement and conservation of forest carbon stocks".

2.2. Transparency in accounting

In addition to coverage, there is a need for greater transparency with regard to how a country intends to account for the land sector, including forest-related emissions and removals. The modalities of inclusion of LULUCF varies within NDCs. Most countries' submissions seem to imply treatment of LULUCF as any other sector (e.g. energy). Others (in particular, developed countries with commitments under the Kyoto Protocol) suggested they would use special accounting rules. Below are three specific accounting issues and how they are specified (or not) within INDCs and NDCs submitted up to now by countries.

Setting a baseline

The provision of a baseline is critical to understanding and quantifying a country's intended contribution. Experiences so far are limited to Developed countries in the context of the Kyoto Protocol (base year and forest management reference levels) and developing countries in the context of their emerging REDD+ efforts (FRELs/FRLs).

Few countries specified within their NDC what baseline they will apply for the land sector. In some cases, this *may* imply (although it is not entirely clear) that the country intends to treat the land sector (including forests) in the same way as other sectors (e.g. measured against a single base year of emissions, or using a BAU projection). For a few countries, however, the BAU itself is unclear. Some did not provide a quantification of BAU or it's unclear how the land sector (including forests) is integrated within the BAU calculation. Countries also appear to have applied differing interpretations of what "BAU" means (with or without current policies in place).

Countries that provided more specific information on baselines include: (a) those specifying that they will apply Kyoto Protocol rules; and (b) Brazil and the United States specified use of net-net (against base year 2005) for all sectors (including LULUCF). Among other important forested countries: the EU did not specify a baseline approach; Canada's NDC is unclear, particularly whether it will include natural disturbance in the baseline; and Russia's INDC was not clear, but strongly hinted at the use of a gross-net approach for the forest sink.

Inclusion of Harvested wood products

IPCC Guidelines in their methodological supplement for the second commitment period of the Kyoto Protocol provide multiple options for countries to report on HWP (as a new pool):

Approach	Explanation
Stock Change Approach	Net emissions from all wood consumed in the country (including imports)
Production Approach	Net emissions from all wood produced in the country (including exports)
Atmospheric-flow Approach	Similar to the stock change approach but different calculations
Simple Decay	Similar to the production approach but different calculations

Most developing countries do not calculate removals from HWPs. Among developed countries, only three appear to have specified which approach they would use: Canada, New Zealand and the United States (all specified a production approach)—although one may assume that Kyoto Protocol Parties are likely to continue with same approach they used under the Kyoto Protocol.

Treatment of natural disturbances

How countries plan to treat natural disturbances can make a significant difference in the stated contribution. The feasibility of removing the impact from such disturbances has been controversial and the is little to no experience by countries in accounting for them. While emissions are reported in the GHGI using the managed land proxy, when assessing progress in meeting NDCs, for *accounting* purposes, some countries may want to exclude what is considered as "natural disturbances beyond the human control"[7] that occur on managed land:

"…when assessing performance relative to a national target, countries may wish under certain circumstances to exclude a portion of emissions and removals associated with disturbances on the basis that the magnitude of disturbance events may overcome the capacity of humans to take them under control and limit their impact. An approach to do this has been agreed for use under the Kyoto Protocol, which requires inventory reporting of disturbance emissions for transparency, which will be important in assessing progress with overall climate goals. The Kyoto rules also require evidence of action taken to limit such occurrences, and disallow exclusion of emissions if the disturbance is followed by land-use change. While the Paris Agreement has not yet established any specific rules or guidance on how countries may account for natural disturbances in the achievement of their NDC, it recognizes that existing methods and guidance should be taken into account."[8]

The accounting rules developed under the Kyoto Protocol[9], and subsequently the methodologies elaborated by IPCC[10], consists of calculating a background level of emissions and removals, defined as the observed historical average annual amount of emissions and removals caused by a "normal"[11] level of disturbances, and by replacing the amount of emissions and subsequent removals associated with natural disturbances occurring on their forest land with the background level if in a year in which such amount exceeds the 95% confidence interval of the background level. In the absence of additional IPCC guidance, some developed countries are likely to apply this accounting approach and methodology. To date, five countries have stated intent to use special accounting provisions for natural disturbances (although not always making clear the accounting approach): Australia, Canada, New Zealand, Switzerland and the United States.

Overview of NDC transparency and the inclusion of the LULUCF sector

There are currently ongoing discussions on the "transparency framework" of the Paris Agreement, which may provide guidance for the land sector. In the meantime, a summary of several countries' accounting of forest sector emissions/removals is provided in Table 6 below. Australia and the United States have provided the greatest clarity on their baseline and HWP approach, and intent regarding the potential exclusion of natural disturbances. A few countries specified use of KP rules for LULUCF in accounting their emissions and removals for the sector (Japan, New Zealand, Switzerland). However, there is a need for greater transparency from most countries on how they intend to account for land use including forest emissions/removals (e.g. EU, Norway, Ukraine). Countries where the treatment of LULUCF may have a

[7] Under the Kyoto Protocol, such disturbances are defined in Decision 2/CMP.7, Annex paragraph 1(a): "*Natural disturbances are defined as non-anthropogenic events or nonanthropogenic circumstances. For the purposes of this decision, these events or circumstances are those that cause significant emissions in forests and are beyond the control of, and not materially influenced by, a Party. These may include wildfires, insect and disease infestations, extreme weather events and/or geological disturbances, beyond the control of, and not materially influenced by, a Party. These exclude harvesting and prescribed burning*".

[8] Excerpt from Federici et al, GHG Fluxes from forests: An assessment of national GHG estimates and independent research in the context of the Paris Agreement (2017).

[9] UNFCCC, Decision 2/CMP.7 (Durban CMP), Annex, paragraphs 33-36.

[10] IPCC, 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol.

[11] i.e. a level calculated with an iterative process that excludes statistical outliers (i.e. values outside the 95% confidence interval)

significant impact in the level of ambition of their NDC and represent a significant contribution to the global mitigation include Canada and Russia.

Table 6: Countries' indication of accounting for forest-related emissions and removals in NDCs

Top 12 countries (plus the EU) by forest area (FAO, 2015)

Country	Key issues related to accounting for forests		
	Baseline	HWP	Natural disturbances
Russia	INDC base year: 1990, however Russia states an intent to use "maximum possible account of absorbing capacity of forests" (implying a gross-net approach for the forest sink)	No additional specificity provided on land sector accounting	
Brazil	NDC base year: 2005 Net-net calculation for all sectors is implied	No additional specificity provided on land sector accounting	
Canada	NDC base year: 2005 Specified net-net calculation for land sector	Will use production approach	Will exclude emissions from natural disturbances
United States	NDC base year: 2005 Specified net-net calculation for land sector	Will use production approach	May exclude emissions from natural disturbances using IPCC guidance
China	NDC seems to imply use of a gross-net approach for forest sequestration, as it refers to a full stock-change	No additional specificity provided on land sector accounting	
EU	No specificity provided on land sector accounting approach[12] "Policy on how to include Land Use, Land Use Change and Forestry into the 2030 greenhouse gas mitigation framework will be established as soon as technical conditions allow and in any case before 2020"		
DRC	Quantified BAU baseline (430 Mt in 2030, for all sectors[13])	No additional specificity provided on land sector accounting	
Australia	NDC base year: 2005 Net-net calculation implied for all sectors is implied	No specificity on HWP approach	Will apply IPCC guidance for natural disturbances
Indonesia	Quantified BAU baseline (2.881 Gt in 2030 for all sectors)	No additional specificity provided on land sector accounting	
Peru	No specificity provided on land sector accounting approach (Note: Peru's REDD+ reference level submission suggested use of a projected baseline)		
India	No specificity provided on land sector accounting approach		
Mexico	Quantified BAU baseline (1.11 Gt in 2030 for all sectors)	No additional specificity provided on land sector accounting	
Colombia	No specificity provided on land sector accounting approach Except: "excludes removals from natural forests … subjected to the progress on the definition of accounting rules under the UNFCCC"		

[12] The EU Commission has presented a proposal including how LULUCF may be included in the non-ETS sector, which is now being discussed within the EU.

[13] The DRC's NDC includes a graph with expected forest-related emissions to 2030 in a BAU scenario, but exact numbers are not provided.

2.3. Other issues

In addition to issues around comprehensive coverage and transparency of LULUCF sector emissions and removals, other issues may be of concern in some submitted NDCs, particularly from developing countries. For example, some countries indicated abatement costs for CO_2 tonnes that appear unrealistic—estimates for forest-related emission reductions ranged from less than $1 to over $800 per ton. Other countries put forward unrealistic targets, for example restoring millions of hectares of land (without strong precedent of success in restoration efforts nor taking into account the existence of adaptation constraints). Still others suggested unrealistic estimates of their forest sink—illustrating the value of future reviews to enhance the credibility of NDCs.

2.4. Conclusions

Despite the variable levels of transparency and clarity on how LULUCF or forest-related emissions and removals are included in the NDCs, they represent an important new source of information on forest mitigation. Given the importance that the forest and LULUCF sectors have in future mitigation pathways[14], reducing the current high level of uncertainty of land use and forest-related GHG estimates and clarifying the intent of countries to take action in such sectors is essential. Additional efforts will be required to improve the monitoring and reporting of forest-related emissions and removals, and to translate these into NDCs. Further guidance by the COP, in the context of the transparency framework under development, can enhance the transparency of national accounting, help countries achieve mitigation potential in the sector, and track global progress in reaching Paris Agreement goals.

3. REDD+

The "Cancun decision" on REDD+ defined five forest-related activities that together suggest comprehensive coverage of all GHG fluxes from forests (see figure below).

IPCC category	REDD+ activity
Forest converted to non-forest (F→NF)	Reducing emissions from deforestation
Forest remaining forest (F→F)	Reducing emissions from forest degradation, Sustainable Management of Forests and/or Conservation of forest carbon stocks
Non-forest to forest (NF→F)	Enhancement of forest carbon stocks

COP guidance on REDD+ reference levels states that "significant pools or activities should not be omitted". While this suggests countries should be comprehensive in their coverage of forest-related emissions and removals when constructing reference levels, it also states that countries may take a stepwise approach, incorporating better data, improved methodologies, and adding pools over time.

Generally, countries are including the *most* significant emissions but gaps remain, some of which may be significant (e.g. well over 10% of the total emissions/removals). These gaps are mostly due to a lack of data or because the country deems that data available lacks sufficient accuracy. Because countries submit REDD+ reference levels "in the context of results-based payments", countries sometime omit

[14] Rockstrom et al. (2017). A roadmap for rapid decarbonization. Science., 355.

certain activities, pools or gases (for which they have data which may be included in the GHGI) due to an assumption that the level of uncertainty is too high to receive payment. Omissions are also sometimes justified by illustrating that the exclusion is "conservative" (i.e. would results in lower, rather than higher, "results" or emission reductions).

3.1. What's covered in FREL/FRLs?

To date 25 countries have submitted FREL/FRLs (Brazil has submitted two separate FRELs, one for the Amazon biome and a second for the Cerrado). The information provided in the submissions represent the most detailed data provided in international reports on forests to date and a significant improvement in such data. However, nearly all FREL/FRLs are not comprehensive due to a lack of complete data, or concerns about the quality of data.

Area coverage: While most countries have submitted national FREL/FRLs, five countries have opted to submit subnational reference levels, which is acceptable per COP guidance that this may be done as an interim measure.

	BRAZIL	BRAZIL (II)	CAMBODIA	CHILE	COLOMBIA	COSTA RICA	ECUADOR	ETHIOPIA	HONDURAS	GUYANA	GHANA	INDONESIA	IVORY COAST	MADAGASCAR	MALAYSIA	MEXICO	NEPAL	PARAGUAY	PERU	PNG	REP. CONGO	SRI LANKA	TANZANIA	UGANDA	VIETNAM	ZAMBIA
National															*											
Subnational (administrative)				22%																						
Subnational (biome)	49%	24%			40%														61%							

*Malaysia only includes production forest areas gazetted as Permanent Reserved Forest (PRF) lands, whose areas change annually and comprised 20 to 34% of forests from 1990 to 2012.

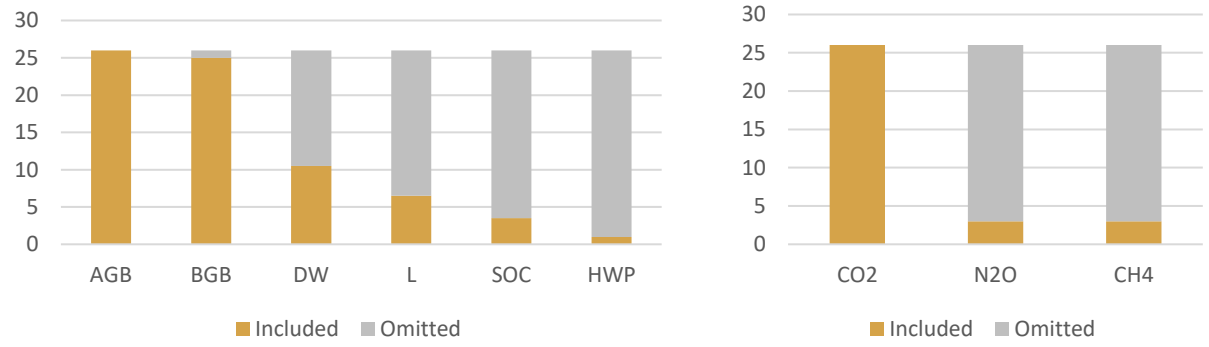
Activities: Most countries include deforestation (except Malaysia), but many lack data on degradation and regrowth, and therefore did not include estimates of forests remaining forests (F→F) or non-forest to forest (NF→F)—even though in some cases estimates are provided in the GHGI included in their NC or the summaries of the GHGI in their BURs. Some included forest degradation but have partially included such estimates—for example, using logging data to estimate forest degradation, but not degradation caused by fuelwood harvesting or fire (as these are more difficult to estimate).

	BRAZIL	BRAZIL (II)	CAMBODIA	CHILE	COLOMBIA	COSTA RICA	ECUADOR	ETHIOPIA	HONDURAS	GUYANA	GHANA	INDONESIA	IVORY COAST	MADAGASCAR	MALAYSIA	MEXICO	NEPAL	PARAGUAY	PERU	PNG	REP. CONGO	SRI LANKA	TANZANIA	UGANDA	VIETNAM	ZAMBIA
Deforestation																										
Degradation																										
Enhancement			**	**		**		*			*		*				**			**		*			*	
SMF																										
Conservation																										

*Conversion from non-forest to forest **Conversion from non-forest to forest and enhancements in forest remaining forest

Pools and Gases: With regard to pools, above and belowground biomass represent the most significant source of emissions for countries, and most include these pools in their FREL/FRLs. Many countries do not include the deadwood, litter, or soil organic carbon pools due to a lack of data; in addition, in a IPCC tier 1 approach, such pools are assumed to be in equilibrium. Furthermore, omission of these pools may be considered conservative in most cases, and deadwood is likely not relevant or significant for most tropical forest countries. Soil may be significant, but few countries have sufficient data on the soil pool. Very few developing countries include harvested wood products (HWP). With regard to gases, many do not include N_2O and CH_4 due to lack of data; some countries include for fire and others provide estimates to demonstrate that such emissions are likely not significant. Generally, only higher capacity countries are able to include N_2O and CH_4.

Number of REDD+ reference level submissions that include the following pools, HWP, and gases:



3.2. Conclusions

Participation in REDD+, including the need to submit forest reference (emission) levels in order to receive results-based financing, has motivated many countries to substantially improve their data on forest-related emissions in the past few years. Submitted FREL/FRLs often provide a higher level of detail on data and information of such emissions (and in some cases removals) than either National Communications or Biennial Update Reports, and therefore much greater transparency. However, GHGI and BURs include emissions and removals more comprehensively, but with less accurate data. In many cases, submissions state that the information used to construct the reference level is improved compared to that used in the last GHGI or BUR report, and that these reports will be updated to reflect the new & improved FREL/FRL data.

Recently some developing countries indicated that the submitted FREL/FRL aimed to enhance their capacities through engagement in the technical assessment process, and to receive guidance on how to improve future submissions—suggesting that countries recognize there is room for improvement. It also illustrates the utility of the UNFCCC technical assessment process, which has increased the level of transparency of data and information on forest GHG fluxes in developing countries. While reference levels may not yet be comprehensive, the submission and review process is having a positive impact on the ability of countries to measure and monitor GHG fluxes from forests.