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**Technical report on the technical analysis of the technical annex to the fourth biennial update report of Brazil submitted in accordance with decision 14/CP.19, paragraph 7, on 31 December 2020**

*Summary*

This technical report covers the technical analysis of the technical annex on the Amazon biome submitted on a voluntary basis, in the context of results-based payments, by Brazil on 31 December 2020 through its fourth biennial update report in accordance with decision 14/CP.19. The technical annex provides data and information on the activity reducing emissions from deforestation, which is an activity included in decision 1/CP.16, paragraph 70, and covers the same subnational territorial forest area of the Amazon biome as the assessed forest reference emission level (FREL) proposed by Brazil in its modified FREL submission of May 2018.

Brazil reported the results of implementing this activity for 2018–2019, which amount to 518,967,155.03 tonnes of carbon dioxide equivalent and were measured against the assessed FREL of 751,780,503.37 tonnes of carbon dioxide equivalent per year.

The data and information provided in the technical annex are in overall accordance with the guidelines contained in the annex to decision 14/CP.19. The technical analysis concluded that the data and information provided by Brazil in the technical annex are mostly transparent and mostly consistent with the data and information used for establishing the assessed FREL in accordance with decision 1/CP.16, paragraph 71(b), and decision 12/CP.17, section II. This report contains the findings from the technical analysis and a few areas identified for capacity-building and future technical improvement in accordance with decision 14/CP.19, paragraph 14.



## Abbreviations and acronyms

AD	activity data
AT	assessment team
BUR	biennial update report
CO <sub>2</sub>	carbon dioxide
CO <sub>2</sub> eq	carbon dioxide equivalent
EF	emission factor
FREL	forest reference emission level
GHG	greenhouse gas
INPE	National Institute for Space Research
IPCC	Intergovernmental Panel on Climate Change
LULUCF	land use, land-use change and forestry
MRV	measurement, reporting and verification
NC	national communication
NFMS	national forest monitoring system
PRODES	Amazon Gross Deforestation Monitoring Project
REDD+	reducing emissions from deforestation; reducing emissions from forest degradation; conservation of forest carbon stocks; sustainable management of forests; and enhancement of forest carbon stocks (decision 1/CP.16, para. 70)
TA	technical analysis
TTE	team of technical experts

## I. Introduction

### A. Introduction

1. This technical report covers the TA of the technical annex provided by Brazil on 31 December 2020 on the Amazon biome in accordance with decision 14/CP.19, paragraph 7, included in its fourth BUR, which was submitted in accordance with decision 2/CP.17, paragraph 41(a), and annex III, paragraph 19. In the technical annex, Brazil provided the data and information used for estimating its anthropogenic forest-related emissions by sources and removals by sinks, forest carbon stocks, and changes in forest carbon stock and forest area resulting from implementing REDD+ activities. The submission of the technical annex is voluntary and in the context of results-based payments in accordance with decision 14/CP.19, paragraph 8. The TA was coordinated by Dirk Nemitz (secretariat).

2. In this context, Brazil underlined that the submission of the technical annex through its fourth BUR does not modify, revise or adjust in any way the nationally appropriate mitigation actions voluntarily submitted by Brazil in accordance with document FCCC/AWGLCA/2011/INF.1, or interfere with its nationally determined contribution under the Paris Agreement.

3. The TA of the technical annex on the Amazon biome is part of the international consultation and analysis of BURs referred to in decision 2/CP.17, annex IV, paragraph 4, the objective of which is to increase the transparency of mitigation actions and their effects through analysis by the TTE in consultation with Brazil and through a facilitative sharing of views, resulting in a separate summary report.<sup>1</sup>

4. Brazil made its first and second FREL submissions on the Amazon biome, in accordance with decision 12/CP.17, on 6 June 2014 and 15 January 2018, respectively, which were subject to a technical assessment following the guidance provided in decision 13/CP.19 and its annex. The latest assessed FREL (FREL C) was included as one of the elements of the technical annex to its fourth BUR in accordance with the guidelines contained in the annex to decision 14/CP.19. The findings from the technical assessment of that FREL are included in a separate report.<sup>2</sup>

5. Brazil previously submitted a technical annex on the Amazon biome to its third BUR on 3 March 2019. The outcome of the TA thereof is contained in document FCCC/SBI/ICA/2019/TATR.3/BRA. Previous FREL submissions, BURs with technical annexes and associated technical assessment and analysis reports for the Party are available online.<sup>3</sup>

### B. Process overview

6. The TA of the fourth BUR of Brazil took place from 28 June to 2 July 2021 as a desk analysis<sup>4</sup> and was undertaken by the following TTE drawn from the UNFCCC roster of experts on the basis of the criteria defined in decision 20/CP.19, annex, paragraphs 2–6: Charles Asumana Sr. (Liberia), Irina Atamuradova (former member of the Consultative Group of Experts from Turkmenistan), Diana Barba (Colombia), Pierre Brender (United Kingdom of Great Britain and Northern Ireland), Paulo Cornejo (Chile), Patience Thelma Melfah Dampsey (former member of the Consultative Group of Experts from Ghana), Elsa Hatanaka (Japan), Benise Nissa Joseph (Saint Lucia), Brittany Meighan (Belize), Walter Oyhantcabal (Uruguay), Marieke Sandker (Netherlands), John Steller (United States of America), Hartley Walimwipi (Zambia), Jongikhaya Witi (South Africa) and Brian Zutta (Peru). Mr. Steller and Mr. Witi were the co-leads. Mr. Brender and Mr. Oyhantcabal were

<sup>1</sup> FCCC/SBI/ICA/2021/TASR.4/BRA.

<sup>2</sup> FCCC/TAR/2018/BRA published on 12 July 2019.

<sup>3</sup> <https://redd.unfccc.int/submissions.html?country=bra>.

<sup>4</sup> Owing to the circumstances related to the coronavirus disease 2019, the TA of the fourth BUR submitted by Brazil had to be conducted remotely.

the LULUCF experts who undertook the TA of the technical annex on the Amazon biome in accordance with decision 14/CP.19, paragraphs 10–13.

7. The TA of the technical annex provided by Brazil on the Amazon biome was undertaken in accordance with the procedures contained in decisions 2/CP.17, 14/CP.19 and 20/CP.19. This technical report on the TA was prepared by the LULUCF experts in the TTE in accordance with decision 14/CP.19, paragraph 14.

8. During the TA and subsequent exchanges, the LULUCF experts and Brazil engaged in technical discussions, and Brazil provided clarifications in response to questions raised by the LULUCF experts, in order to reach a common understanding on the identification of the areas for technical improvement. As a result of the facilitative interactions with the LULUCF experts during the TA, Brazil submitted a modified version of its technical annex on 8 July 2021.

9. Following the TA of the technical annex, the LULUCF experts prepared and shared the draft technical report with Brazil for its review and comments. The LULUCF experts responded to the Party's comments and incorporated them into and finalized this technical report in consultation with Brazil. This technical report on the TA of the technical annex was prepared in the context of the modified technical annex submitted by Brazil.

### C. Summary of results

10. In decision 1/CP.16, paragraph 70, the Conference of the Parties encouraged developing country Parties to contribute to mitigation actions in the forest sector by undertaking a number of activities, as deemed appropriate by each Party in accordance with its respective capabilities and national circumstances. In the context of results-based payments and in line with decision 12/CP.17, Brazil, on a voluntary basis, proposed a subnational FREL covering the activity reducing emissions from deforestation for the purpose of a technical assessment in accordance with decision 13/CP.19 and its annex. The activity is being implemented in Brazil's Amazon biome, which covers an area of approximately 4,196,943 km<sup>2</sup>, comprising 49 per cent of the national territory and 67 per cent of the country's total forest land. The assessed FREL (FREL C) of Brazil for the Amazon biome is 751,780,503.37 t CO<sub>2</sub> eq/year.

11. The Party's FREL (FREL C) is based on its annual average historical CO<sub>2</sub> emissions associated with the activity reducing emissions from deforestation in the Amazon biome for the historical reference period 1996–2015.<sup>5</sup> FREL C, an update of FREL A and FREL B, is to be applied as a benchmark to calculate emission reduction results for the Amazon biome over 2016–2020. Brazil reported the results of implementing the activity for 2018–2019,<sup>6</sup> calculated against the FREL, which amount to emission reductions of 273,253,239.3 t CO<sub>2</sub> eq annually. As a result of the TA, Brazil submitted a modified technical annex with corrected calculations, with emission reductions amounting to 259,483,577.52 t CO<sub>2</sub> eq annually.

12. Measured against the same FREL (FREL C), Brazil previously submitted results amounting to 377,344,006.03 and 391,656,866.92 t CO<sub>2</sub> for 2016 and 2017, respectively, which were assessed in 2019.<sup>7</sup>

13. Brazil submitted its first FREL submission covering the Amazon biome for technical assessment in 2014.<sup>8</sup> The assessed FRELs forming part of this submission (FREL A and FREL B) were 1,106,027,616.63 t CO<sub>2</sub> eq/year for the reference period 1996–2005 and 907,959,466.33 t CO<sub>2</sub> eq/year for the reference period 1996–2010. Measured against the value for FREL A, Brazil also submitted results amounting to 594,204,450.9 t CO<sub>2</sub> eq/year for 2006–2010, which were assessed in 2015;<sup>9</sup> and measured against the value for FREL B,

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<sup>5</sup> See document FCCC/TAR/2018/BRA.

<sup>6</sup> As most of the satellite images used were acquired between the months of July and September in 2017, 2018 and 2019, the reported deforestation rates are more representative of deforestation between September 2017 and August 2019 than deforestation over the calendar years 2018–2019.

<sup>7</sup> See document FCCC/SBI/ICA/2017/TATR.2/BRA.

<sup>8</sup> See document FCCC/TAR/2014/BRA.

<sup>9</sup> See document FCCC/SBI/ICA/2015/TATR.1/BRA.

results amounting to 630,900,345.4 t CO<sub>2</sub> eq/year for 2011–2015, which were assessed in 2017.<sup>10</sup>

## **II. Technical analysis of the information reported in the technical annex**

### **A. Technical annex**

14. For the technical annex on the Amazon biome to the fourth BUR submitted by Brazil, see annex I.<sup>11</sup>

### **B. Technical analysis**

15. The scope of the TA is outlined in decision 14/CP.19, paragraph 11, according to which the TTE shall analyse the extent to which:

- (a) The methodologies, definitions, comprehensiveness and information provided are consistent between the assessed FREL and the results of implementing REDD+ activities;
- (b) The data and information provided in the technical annex are transparent, consistent, complete and accurate;
- (c) The data and information provided in the technical annex are consistent with the guidelines referred to in decision 14/CP.19, paragraph 9;
- (d) The results are accurate, to the extent possible.

16. The remainder of this chapter presents the results of the TA of the technical annex on the Amazon biome to the Party's fourth BUR according to the scope outlined in paragraph 15 above.

#### **1. Consistency in methodologies, definitions, comprehensiveness and information provided between the assessed reference level and the results in the technical annex**

17. In accordance with decision 14/CP.19, paragraph 3, the data and information used by a Party for estimating its anthropogenic forest-related emissions by sources and removals by sinks, forest carbon stocks, and changes in forest carbon stock and forest area resulting from implementing REDD+ activities should be transparent and consistent over time and with the data and information used for establishing its FREL in accordance with decision 1/CP.16, paragraph 71(b–c), and decision 12/CP.17, section II.

18. The LULUCF experts noted that Brazil ensured overall consistency between its assessed FREL and estimated results of implementing the activity reducing emissions from deforestation in 2018–2019 by:

- (a) Using consistent methodologies and data to generate AD on gross deforestation of natural forests; in particular, using the same forest monitoring system (PRODES) to detect deforestation, and making adjustments to either remove cloud-covered areas or include deforestation in previously cloud-covered areas, and using the same minimum mapping unit (6.25 ha);
- (b) Using consistent methodologies and data to generate EFs, in particular the same carbon map and the same stratification for 22 types of forest physiognomy in the Amazon biome and their corresponding EFs;
- (c) Covering the same three carbon pools: above-ground biomass, below-ground biomass and litter;
- (d) Covering the same gas: CO<sub>2</sub> only;

<sup>10</sup> See document FCCC/SBI/ICA/2017/TATR.2/BRA.

<sup>11</sup> In accordance with decision 14/CP.19, para. 14(a).

(e) Covering the same area: the Amazon biome;

(f) Assuming that all carbon from the three carbon pools is lost in the year of the deforestation event without accounting for any regrowth or remaining carbon stock following the event.

19. Brazil adjusted increments of deforestation related to cloud-covered areas, which had an inconsistent impact on the assessed reference level and the results reported. As the results cover a two-year period, which is shorter than the number of years over which increments were redistributed, the adjustment led to reported emissions from deforestation that were lower than the total emissions associated with the increments of deforestation observed in those years, but did not have any impact on the emissions reported in FREL C. However, the AT noted that the impact of this inconsistency on the results for 2018–2019 is small, with just 0.6 per cent of the emissions associated with deforestation increments identified in 2018–2019, or approximately 2.9 Mt CO<sub>2</sub> eq, excluded from the reported results as a result of the adjustment. The LULUCF experts noted that 5 per cent of the emissions associated with the increments of deforestation observed in 2016–2017, or 38.2 Mt CO<sub>2</sub> eq, were excluded from those accounted for against the FREL.<sup>12</sup> The LULUCF experts also noted that reporting the results for 2016–2020 in the same technical annex would have avoided any inconsistency between the emissions reported during the reference and results periods, in which case the adjustment would have just redistributed emissions over the different years of the results period, which would have been an impact equivalent to the one it had on FREL C. In view of the above, the LULUCF experts concluded that the results presented of implementing the activity reducing emissions from deforestation are mostly consistent with the assessed FREL.

## 2. Transparency, consistency, completeness and accuracy of the data and information provided in the technical annex

20. In response to a question from the LULUCF experts on why the technical annex does not specify the forest definition used by the Party, Brazil explained that the forest definition is consistent with that used in the GHG inventory included in its NC3 and that the technical annex refers to the FREL submission for information on mapping scales, legends and the PRODES “forest mask”. The AT notes that the Party could improve the transparency of the technical annex by including directly in the technical annex the forest definition used, specifying that it is consistent with that used in the FREL submission and the GHG inventory included in the NC3 and the BUR, and explaining the impact of using a minimum mapping unit of 6.25 ha, which is much larger than the minimum area included in the forest definition (0.5 ha), on the results.

21. The technical annex includes references to several weblinks that were not functioning at the time of the TA. However, Brazil provided access to all corresponding documents to the LULUCF experts, including the carbon stock map used as the source of EFs, the deforestation increment polygons for 2018–2019, the cloud masks for 2015–2018 used to adjust the deforestation increments, the spreadsheet used to analyse the intersection between cloud masks and subsequent deforestation increments, and the boundaries of the Amazon biome. As part of the TA process, Brazil also provided additional information, in particular on uncertainty analyses of the PRODES AD. The LULUCF experts commend Brazil for its efforts to increase the transparency and ensure the completeness<sup>13</sup> of the data and information provided, thus allowing for reconstruction of the results by the experts, but note that it could enhance transparency by making the information shared with the AT publicly available on its REDD+ information hub.<sup>14</sup>

22. In the technical annex (section 3), Brazil reported that “the increments of deforestation (2018 to 2019) were adjusted until 2015 to avoid over or under-estimating the emissions from deforestation, due to the non-observation of potential deforestation polygons in areas covered by clouds”. The AT noted that this statement is not entirely accurate as the methodology applied does not allow emissions from deforestation in cloud-covered areas in the latest reporting year (2019) to be taken into account. According to data shared by Brazil during the

<sup>12</sup> See table in annex III.B to document FCCC/SBI/ICA/2019/TATR.3/BRA.

<sup>13</sup> “Complete” here means including the information necessary for reconstructing the results.

<sup>14</sup> <http://redd.mma.gov.br/en/infohub>.

TA, 86,546.62 ha, or 8 per cent, of the PRODES 2020 deforestation increment occurred in cloud-covered areas in 2019. Brazil noted, however, that these data were not available at the time it was finalizing its submission and consequently could not be accounted for at that time. The AT therefore notes improvements to the approach to addressing cloud cover as an area for technical improvement, wherein an adjustment is made to prevent both the underestimation and the overestimation of emissions. In response to a question from the AT on issues related to the cloud cover adjustment, Brazil noted that it has decided to adopt a methodology for developing its national FREL that does not include adjustments for cloud cover and is based on AD made publicly available by PRODES, as this will be simpler to manage and more accessible overall. Brazil also noted that not including any adjustments for cloud cover would have a limited impact on accuracy, as the greater availability of satellite data in recent years has allowed INPE to substantially reduce the impact of cloud cover on the PRODES deforestation increment.

23. According to decision 12/CP.17, paragraph 8, the FREL shall be established taking into account decision 4/CP.15, paragraph 7, and maintaining consistency with the anthropogenic forest-related GHG emissions by sources and removals by sinks reported in the Party's GHG inventory. The team assessing Brazil's FREL C noted that the Party maintained consistency in terms of sources of AD and EFs with those used for the GHG inventory included in its NC2, which was the most recent NC when Brazil submitted its first FREL for the Amazon biome.<sup>15</sup> Thus, the assumptions used differ from those used for Brazil's GHG inventory included in its NC3, for its fourth BUR and for the GHG inventory included in its NC4.<sup>16</sup> The LULUCF experts noted that this is also true for the estimated results of implementing the activity reducing emissions from deforestation for 2018–2019.

24. To ensure consistency between FREL C and the results, the results presented in the technical annex assume the immediate oxidation of all carbon stocks in biomass and litter in the year in which the deforestation event occurred and do not account for regrowth after deforestation (see section 4.2 of the technical annex).

25. In the technical annex (section 7.1), Brazil stated that its FREL C and the associated technical annex consider any carbon stock present to be lost immediately upon conversion of forest land to other land uses. In response to a question from the AT, Brazil clarified that the EF used means that any losses from forest degradation that may have occurred in the years before the deforestation event are effectively accounted for in the year in which an area is identified as having been converted to non-forest land.

26. The technical annex did not include an uncertainty assessment for the results for 2018–2019. In response to questions from the LULUCF experts, Brazil confirmed that it has not estimated the accuracy of the deforestation maps for 2018–2019. However, Brazil shared assessments of the accuracy of PRODES maps from earlier years (Adami et al., 2017; Maurano et al., 2019), noting that there have not been any changes in the mapping protocol or interpretation keys used that would significantly change the accuracy of the maps. Brazil also stated that PRODES data are subject to quality control checks, including an internal audit carried out during the mapping and a review at the end of the process, and that those steps ensure the high accuracy of the estimates of deforestation areas.

27. Brazil used the carbon map included in its second national GHG inventory rather than a more recent map for estimating FREL C and the results in 2018–2019. In the technical annex (section 2), Brazil mentioned that using the carbon map developed for the third national GHG inventory (and used for its fourth BUR) would not significantly impact its FREL C, but the Party did not include an equivalent assessment showing the impact on the results for 2018–2019. The information shared by Brazil during the TA did not allow the LULUCF experts to quantitatively estimate whether using the carbon map included in the national GHG inventory included in Brazil's NC4 would significantly affect the results reported for 2018–2019.

<sup>15</sup> Available at <https://unfccc.int/documents/69067>.

<sup>16</sup> Available at <https://unfccc.int/documents/66129>, <https://unfccc.int/documents/267661> and <https://unfccc.int/documents/267657>, respectively.

28. In response to a question from the LULUCF experts, Brazil clarified that most data (images, annual maps and deforestation increments from PRODES) are publicly available, but that the carbon map and the files containing information on the adjustments to the deforestation increments are not, which therefore does not enable stakeholders to reconstruct losses of forest stocks from deforestation consistently between FREL C and the results included in the technical annex. The LULUCF experts commend Brazil for providing material allowing the experts to reproduce Brazil's estimates in response to the experts' questions.

29. The LULUCF experts concluded that Brazil provided the information necessary for reconstructing the results of implementing the activity reducing emissions from deforestation. The data and information provided in the technical annex are considered to be mostly transparent, mostly consistent, complete and mostly accurate.

### 3. Consistency with the guidelines on elements to be included in the technical annex

30. Brazil provided data and information on all the required elements in accordance with the guidelines contained in the annex to decision 14/CP.19, namely summary information from the final report containing the assessed FREL; results in t CO<sub>2</sub> eq/year, consistent with the assessed FREL; a demonstration that the methodologies used to produce the results are mostly consistent with those used to establish the assessed FREL (as outlined in chap. II.B.1 above); a description of forest monitoring systems and institutional roles and responsibilities in MRV of the results; the information necessary for reconstructing the results (as outlined in chap. II.B.2 above); and a description of how the elements contained in decision 4/CP.15, paragraph 1(c–d), have been taken into account.

31. Brazil provided a summary table with the results of implementing the activity reducing emissions from deforestation for 2018–2019, which are consistent with the assessed FREL, thus allowing for reconstruction of the results. The emission reductions achieved are listed in table 2 of the technical annex and amount to 259,483,577.52 t CO<sub>2</sub> eq/year for the two years covered (345,428,734.49 t CO<sub>2</sub> eq in 2018 and 173,538,420.54 t CO<sub>2</sub> eq in 2019).

32. The LULUCF experts noted that Brazil provided a description of the forest monitoring system and a transparent summary of the roles and responsibilities of the agencies and institutions involved in MRV of the results in the technical annex, together with weblinks for accessing further information. During the consultation process, Brazil noted that it has been making significant efforts to improve and expand its NFMS coverage in terms of area and time series. The LULUCF experts commend Brazil for sharing this information.

33. The forest monitoring system is a subnational system covering the Amazon biome. This system is part of the NFMS, which is used for implementing and monitoring nationally appropriate mitigation actions for the LULUCF sector and conducting MRV of REDD+ results. The Ministry of Environment established the Brazilian Biomes Environmental Monitoring Programme for the purpose of monitoring deforestation, land cover and use, selective logging, forest fires and recovery of native vegetation. INPE developed PRODES to monitor gross deforestation in natural forest in the Legal Amazon through use of satellite imagery. This system is key to expanding land-cover monitoring to the other Brazilian biomes.

34. According to decision 11/CP.19, paragraph 4(b), the NFMS should enable the assessment of different types of forest in the country, including natural forest. In its technical annex, Brazil reported that it used a carbon map for the Amazon biome with 22 types of forest physiognomy, which is consistent with the approach used for constructing its FREL, and reported that only primary (natural) forest is included.

35. According to decision 1/CP.16, paragraph 71(c), footnote 7, subnational monitoring and reporting should include monitoring and reporting emission displacement at the national level, if appropriate, and reporting on how the displacement of emissions is being addressed and on the means of integrating subnational monitoring systems into a national monitoring system. The LULUCF experts noted that the subnational monitoring and reporting for the Amazon biome does not include monitoring and reporting emission displacement at the national level. In response to a question by the LULUCF experts, Brazil noted that it has been making committed efforts to expand the coverage of its NFMS in terms of both area and time



series. During the TA, Brazil noted that data available to date from its NFMS for the Atlantic Forest, Caatinga, Pampa and Pantanal may not be sufficient for assessing potential displacement. Brazil added, however, that there is political and institutional pressure to prevent and control deforestation in all Brazilian biomes, underlined by the launch of the National Plan for the Control of Illegal Deforestation and Recovery of Native Vegetation and a programme to promote payments for environmental services for conservation and recovery of native vegetation called Floresta+. The Party also mentioned that its submission of a national FREL by 2022 will hopefully provide a reliable time series of AD for all biomes and thus generate some findings related to displacement of emissions, while recognizing that the assessment of displacement is complex. On the basis of the available information, the LULUCF experts noted that, so far, there is no evidence of significant displacement of emissions resulting from policies implemented in the Amazon biome to biomes not covered by a FREL. The LULUCF experts noted the monitoring and reporting of emission displacement at the national level as an area for technical improvement as long as the Party is reporting results against a subnational FREL.

36. Brazil provided a description of how IPCC guidance and guidelines were taken into account in accordance with decision 4/CP.15, paragraph 1(c). For estimating emission reductions in the Amazon biome, Brazil used the methodology provided in the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* for estimating carbon stocks in forest land converted to other land uses. Accordingly, emissions from deforestation were estimated for 2018–2019 by combining AD (i.e. areas of annual deforestation) with the appropriate EFs (i.e. emissions associated with the corresponding forest type).

37. In constructing its FREL and estimating the results, Brazil covered the most significant pools: above-ground biomass, below-ground biomass and litter. Overall, the exclusion of the soil organic carbon and deadwood pools and non-CO<sub>2</sub> gases as part of a stepwise approach was adequately justified. The LULUCF experts commend Brazil for its intention to obtain better information on soil organic carbon and non-CO<sub>2</sub> gases with the aim of including them in future FRELS and estimates of results as part of the stepwise approach.

#### 4. Accuracy of the results proposed in the technical annex

38. The LULUCF experts noted that the Party estimated the results of implementing the activity reducing emissions from deforestation in the Amazon biome using a mostly transparent and mostly consistent approach. They commend Brazil for its significant long-term efforts to build up a robust NFMS that is capable of providing transparent estimates of emissions from deforestation.

39. Both the established FREL and the results obtained for 2018–2019 from implementing the activity are based on the assumptions that deforestation takes place in areas with intact forests that have carbon content as determined by the carbon density map, and the carbon stocks of the pools covered by the FREL are zero after conversion. The LULUCF experts noted that, because regrowth following the deforestation event was not accounted for, the net emissions from deforestation have most likely been overestimated. If the carbon densities in these areas have been lowered before a clear-cut event, for example owing to human activities or forest fires, then the emission estimates have been used to construct the FREL and the results include both the emissions from deforestation and the emissions from forest degradation processes that occurred previously. In addition, the LULUCF experts noted that, because regrowth following the deforestation event was not accounted for, the net emissions from deforestation have most likely been overestimated. They also noted that, because Brazil has used a mostly consistent methodology for estimating emissions in establishing the FREL and the results for 2018–2019, the overestimates of the emissions over the reference period and 2018–2019 will partially cancel out.

40. As mentioned in paragraph 26 above, Brazil provided some information related to the accuracy of the PRODES increments of deforestation, which are, after adjustment for cloud cover, used as AD. However, this information was not used in assessing the uncertainty of the emission estimates and was only available for 2014, while previous analyses have suggested that the accuracy of the estimates for the late 1990s and early 2000s included in the construction of FREL C may be lower. Thus, the effect of the uncertainty on the accuracy of the results of implementing the activity reducing emissions from deforestation could not

be assessed. Despite this, and given the assumptions used, the LULUCF experts concluded that the results are mostly accurate.

### **C. Areas identified for technical improvement**

41. The LULUCF experts concluded that the following areas for technical improvement identified in the report on the technical assessment of Brazil's FREL C also apply to the provision of information on the results of implementing the activity reducing emissions from deforestation:

(a) Exclude the less accurate AD (see document FCCC/TAR/2018/BRA, para. 19) from future submissions;

(b) Provide information on the extent of deforested areas that are detected at the 1 ha threshold but not retrieved later by PRODES using a 6.25 ha threshold, with the aim of showing that no significant deforestation is excluded from the FREL (see document FCCC/TAR/2018/BRA, para. 20);

(c) Provide information on how the EFs were derived for the five vegetation types that were not included in the 22 forest types of the FREL (see document FCCC/TAR/2018/BRA, para. 23);

(d) Provide a territorial matrix of the Amazon biome in the FREL with the distribution considered by the NC and by the FREL, along with a clear description of any methodological differences (see document FCCC/TAR/2018/BRA, para. 26);

(e) Better explain the difference of 5,573,793.6 ha between the PRODES deforestation increments in the NC3 and in the FREL (see document FCCC/TAR/2018/BRA, para. 27);

(f) Strengthen the quality control of the submission to eliminate inconsistencies (see document FCCC/TAR/2018/BRA, para. 29).

42. Furthermore, the LULUCF experts concluded that the following areas for technical improvement identified in the report on the technical assessment of Brazil's results for 2016–2017 also apply to the technical annex being analysed:

(a) Improving the documentation of the adjustments related to cloud cover in future submissions (see annex III.C for relevant information shared by Brazil during the TA) and reporting the results obtained from the procedure for identifying deforestation using different medium-resolution images as an alternative to using cases of cloud cover in Landsat images, since this has helped in identifying deforestation since 2012 (see document FCCC/SBI/ICA/2019/TATR.3/BRA, para. 20; and para. 19 above);

(b) Continuing the assessment of forest degradation resulting from anthropogenic actions and the related emissions in the case of degraded areas being subsequently deforested (see document FCCC/SBI/ICA/2019/TATR.3/BRA, para. 34; and paras. 25 and 39 above);

(c) Providing information on improvements related to uncertainties within the monitoring system managed by INPE (e.g. PRODES); for example, providing information on the use of Landsat 8 images, which have lower associated uncertainties than Landsat 5 images (see document FCCC/SBI/ICA/2019/TATR.3/BRA, para. 35; and para. 40 above).

43. In addition, the LULUCF experts would like to note the following areas for technical improvement:

(a) Reporting results in a way that ensures that any adjustment does not have a different impact on emissions accounted for over the reference period and across the years for which results are reported (see para. 19 above);

(b) Improving the transparency of its reporting by including the forest definition used, specifying that it is consistent with FREL C and the GHG inventory reported in the BUR and explaining the impact of using a minimum mapping unit of 6.25 ha (see para. 20 above);

(c) Improving the transparency of its reporting by ensuring that weblinks included in the technical annex remain functional after publication of the technical annex (see para. 21 above);

(d) Improving the approach to address cloud cover with a view to preventing emissions from being under- or overestimated (see para. 22 above);

(e) Monitoring and reporting emission displacement at the national level as long as results are reported against a subnational FREL (see para. 35 above).

#### **D. Comments and responses of the Party**

44. During the consultation process, Brazil noted a number of areas of capacity-building needs. Addressing those needs could enable Brazil to improve its data and methodologies, move from subnational to national coverage and include additional activities and gases in future FREL submissions. After exchanges with the LULUCF experts, Brazil did not note any areas of capacity-building needs in addition to the areas for future technical improvement identified in paragraph 41 of document FCCC/TAR/2018/BRA.

### **III. Conclusions**

45. The LULUCF experts conclude that Brazil reported the results of implementing one activity, which is defined as the deforestation of primary forests, and by following a subnational approach covering Brazil's Amazon biome, which represents 49 per cent of the national territory. The results include estimates of emissions of CO<sub>2</sub> from three carbon pools: above-ground biomass, below-ground biomass and litter from deforestation identified as clear-cuts of a minimum mapping unit of 6.25 ha for 2018–2019. The results of the activity were estimated and reported using methodologies, definitions, assumptions and information that are mostly consistent with those used for constructing the assessed FREL.

46. The LULUCF experts consider the data and information provided in the technical annex to be mostly transparent, mostly consistent, complete and mostly accurate.

47. The LULUCF experts find the data and information provided in the technical annex to be consistent with the guidelines referred to in decision 14/CP.19, paragraph 9.

48. The results are mostly accurate, based on the assumptions used. The LULUCF experts note that Brazil has initiated a number of programmes for assessing possible displacement of emissions while taking steps to implement an NFMS (see also paras. 41–42 above on areas identified for technical improvement). In addition, they note that, at present, information from the monitoring of other forest biomes and degradation in the Amazon biome indicates that displacement of emissions is not a major issue.

49. In conclusion, the LULUCF experts commend Brazil for showing strong commitment to continuously improving the data and information used for calculating the results, in line with the stepwise approach, which are mostly consistent with those used for constructing its assessed FREL. Some areas for future technical improvement have been identified in this report. At the same time, the LULUCF experts acknowledge that such improvements are subject to national capabilities and circumstances, and note the importance of adequate and predictable support.<sup>17</sup> The LULUCF experts also acknowledge that the TA process was an opportunity for a facilitative and constructive technical exchange of views and information with Brazil.<sup>18</sup>

<sup>17</sup> As per decision 2/CP.17, para. 57.

<sup>18</sup> As per decision 14/CP.19, paras. 12–13.

## **Annex I**

### **Technical annex to the biennial update report**

Owing to the complexity and length of the submitted technical annex to the BUR, and in order to maintain the original formatting, the technical annex has not been reproduced here. It is available on the UNFCCC website at <https://unfccc.int/BURs>.

## Annex II

### Summary of the main features of the reported results of implementing the activities referred to in decision 1/CP.16, paragraph 70, based on information provided by Brazil

	<i>Key elements</i>	<i>Remarks</i>
Results reported	259 483 577.52 t CO <sub>2</sub> eq/year (345 428 734.49 t CO <sub>2</sub> eq in 2018 and 173 538 420.54 t CO <sub>2</sub> eq in 2019)	See paragraphs 11 and 31 of this document
Results period	2018–2019	See paragraph 11 of this document
Assessed FREL	751 780 503.37 t CO <sub>2</sub> eq/year	See document FCCC/TAR/2018/BRA, published on 12 July 2019 (see para. 10 of this document)
Reference period	1996–2015	
National/subnational	Subnational	The FREL and the proposed results cover the Amazon biome (see para. 11 of this document)
Activity included	Reducing emissions from deforestation	See paragraph 11 of this document
Pools included	Above-ground biomass Below-ground biomass Litter	After the deforestation event, living biomass and litter are assumed to be zero and no regrowth is accounted for (see para. 39 of this document)
Gas included	CO <sub>2</sub>	FREL C and the results include CO <sub>2</sub> emissions only (see paras. 11 and 18(d) of this document)
Consistency with assessed FREL	Methods, definitions and information used for the assessed FREL are mostly consistent with those used for the results	See paragraphs 18–19 of this document
Description of NFMS and institutional roles	Included	See paragraphs 32–34 of this document
Identification of future technical improvements	Included	Several areas for future technical improvement have been identified (see paras. 41–43 of this document)

## Annex III

### Reference documents

#### A. Reports of the Intergovernmental Panel on Climate Change

IPCC. 2003. *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. J Penman, M Gytarsky, T Hiraishi, et al. (eds.). Hayama, Japan: Institute for Global Environmental Strategies. Available at <http://www.ipcc-nggip.iges.or.jp/public/gpplulucf/gpplulucf.html>.

#### B. UNFCCC documents

First and second modified FREL submissions of Brazil. Available at <https://redd.unfccc.int/submissions.html?country=BR>.

“Guidelines and procedures for the technical assessment of submissions from Parties on proposed forest reference emission levels and/or forest reference levels”. Annex to decision 13/CP.19. Available at <https://unfccc.int/sites/default/files/resource/docs/2013/cop19/eng/10a01.pdf#page=36>.

“Guidelines for submissions of information on reference levels”. Annex to decision 12/CP.17. Available at <https://unfccc.int/sites/default/files/resource/docs/2011/cop17/eng/09a02.pdf#page=19>.

Report on the technical assessment of the proposed FREL of Brazil submitted in 2018. FCCC/TAR/2018/BRA. Available at <https://redd.unfccc.int/submissions.html?country=BR>.

#### C. Other documents

The following references have been reproduced as received:

Adami, M., Gomes, A.R., Beluzzo, A., COELHO, A.D.S., VALERIANO, D.D.M., RAMOS, F.D.S., NARVAES, I.D.S., Brown, I.F., de Oliveira, I.D., Santos, L.B. and Maurano, L.E.P., 2017. A confiabilidade do PRODES: estimativa da acurácia do mapeamento do desmatamento no estado Mato Grosso. In Embrapa Amazônia Oriental- Artigo em anais de congresso (ALICE). In: SIMPÓSIO BRASILEIRO DE SENSORIAMENTO REMOTO, 18., 2017, Santos. Anais... São José dos Campos: INPE, 2017. [https://www.alice.cnptia.embrapa.br/bitstream/doc/1085664/1/galoaproceedingsbsr59299a\\_confiabilidade.pdf](https://www.alice.cnptia.embrapa.br/bitstream/doc/1085664/1/galoaproceedingsbsr59299a_confiabilidade.pdf).

Maurano, Luis Eduardo Pinheiro, Maria Isabel Sobral Escada, and Camilo Daleles Renno. "Padrões espaciais de desmatamento e a estimativa da exatidão dos mapas do PRODES para Amazônia Legal Brasileira." *Ciência Florestal* 29 (2019): 1763-1775. [http://mtc-m21c.sid.inpe.br/attachment.cgi/sid.inpe.br/mtc-m21c/2019/12.13.10.44/doc/maurano\\_padroes.pdf](http://mtc-m21c.sid.inpe.br/attachment.cgi/sid.inpe.br/mtc-m21c/2019/12.13.10.44/doc/maurano_padroes.pdf).

The documents and information set out below were provided by the Party in response to requests for clarification or additional information during the TA:

- Simple guide to reconstruct emissions from deforestation in the Amazon biome for 2018 and 2019
- Corresponding spreadsheets of calculation

Brazil adjusted the increments of deforestation (2018 to 2019) until 2015 to avoid over- or underestimating the emissions from deforestation, due to the non-observation of potential deforestation polygons in areas covered by clouds in previous years (see paragraph 19). The cloud adjustment was performed only for the 4 years prior to the most

recent increment of deforestation, since it has been the period with the largest variations (as reported in FREL C, Table 1).

In Table 2 of the Technical Annex Brazil reports the annual CO<sub>2</sub> emissions for 1996-2015 as well as the adjusted one for 2015-2019. During the consultation Brazil provide the TAT with the emission data for 2018 and 2019 as well as a “Simple guide to the reconstruction of the results 2018–2019 for Amazonia biome”.

With this information and the associated Worksheets, the method applied to conduct the adjustment as well as the steps within the method became clearer.

Steps within the adjustment

The adjustment is conducted in 4 steps for the area of increments of deforestation:

- Step 1 is the determination of the ‘potential’ area. This is the area of deforested area in 2018 and 2019 that have been covered by clouds in the year(s) preceding their identification as deforestation increments
- Step 2 is the subtraction of the area identified in step 1 from the total of areas deforested in the year when they were identified
- Step 3 is their repartition in equal proportion between the year when they were identified and the preceding years when they were covered by clouds.
- Step 4 is the resulting adjusted area.

For the areas in each step the emissions from increments of deforestation are estimated, using the same emission factors as in the FREL C.

In the table the numbers of these steps are presented for the years 2015–2019. The numbers in the last column (final emissions) are equal to those presented in the column “Annual adjusted CO<sub>2</sub> emissions until 2015” of table 2, page 56 of the Technical Annex.

Year	Area of increments of deforestation	Area (+)	Area (-)	Final area	Emission from increments of deforestation	Emission (+)	Emission (-)	Final emission
2015		93.30				59 165.67		319 244 077.30
2016		433.21				303 722.49		374 740 219.83
2017		4 364.15				2 554 728.78		362 678 365.23
2018	676 151.09	42 127.58	2 599.19	673 551.90	380 478 192.15	27 539 323.58	-1 665 746.85	378 812 445.30
2019	1 066 213.89		44 419.05	1 021 794.84	607 033 276.50		-28 791 193.67	578 242 082.83