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Report of the technical assessment of the proposed forest reference emission level of Brazil submitted in 2018

Summary

This report covers the technical assessment of the voluntary submission of Brazil on its proposed forest reference emission level (FREL), in accordance with decision 13/CP.19 and in the context of results-based payments. The FREL proposed by Brazil covers the activity "reducing emissions from deforestation", which is among the activities included in decision 1/CP.16, paragraph 70. For its submission, Brazil developed a subnational FREL for the Amazonia biome with the aim of transitioning to a national FREL in the future. The FREL presented in the original submission, for the reference period 1996–2015, corresponds to 750,234,380 tonnes of carbon dioxide equivalent per year (t CO_2 eq/year). As a result of the facilitative process during the technical assessment, the FREL was modified to 751,780,503.37 t CO_2 eq/year. The assessment team notes that the data and information used by Brazil in constructing its FREL were improved during the TA and are transparent and complete and in overall accordance with the guidelines contained in the annex to decision 12/CP.17. This report contains the assessed FREL and a few areas identified by the assessment team for future technical improvement, in accordance with the provisions on the scope of the technical assessment contained in the annex to decision 13/CP.19.

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Contents

		Paragraphs	*Page*
I.	Introduction and summary	1–11	3
	A. Overview	1–6	3
	B. Proposed forest reference emission level	7–11	4
II.	Data, methodologies and procedures used in the construction of the proposed forest reference emission level	12–36	5
	How each element in the annex to decision 12/CP.17 was taken into account in the construction of the forest reference emission level	12–36	5
III.	Conclusions	37–45	10
Annex			
	Summary of the main features of the proposed forest reference emission level based on information provided by Brazil		13

I. Introduction and summary

A. Overview

1. This report covers the technical assessment (TA) of the submission of Brazil on its proposed forest reference emission level (FREL),[1] submitted on 15 January 2018 in accordance with decisions 12/CP.17 and 13/CP.19. The TA took place (as a centralized activity) from 19 to 23 March 2018 in Bonn, Germany, and was coordinated by the UNFCCC secretariat.[2] The TA was conducted by two land use, land-use change and forestry experts from the UNFCCC roster of experts[3] (hereinafter referred to as the assessment team (AT)): Ms. Andrea Brandon (New Zealand) and Ms. Marina Shvangiradze (Georgia). In addition, Mr. Thiago de Araújo Mendes, an expert from the Consultative Group of Experts on National Communications from Parties not included in Annex I to the Convention, participated as an observer[4] during the centralized activity in Bonn. The TA was coordinated by Mr. Dirk Nemitz (UNFCCC secretariat).

2. In response to the invitation of the Conference of the Parties (COP) and in accordance with the provisions of decision 12/CP.17, paragraphs 7–15, and its annex, Brazil submitted its proposed FREL on a voluntary basis. This proposed FREL is one of the elements[5] to be developed in the implementation of the activities referred to in decision 1/CP.16, paragraph 70. The COP decided that each submission of a proposed FREL, as referred to in decision 12/CP.17, paragraph 13, shall be subject to a TA in the context of results-based payments, pursuant to decision 13/CP.19, paragraphs 1 and 2, and decision 14/CP.19, paragraphs 7 and 8.

3. In this context, Brazil underlines that the submission of FRELs and/or forest reference levels (FRLs) and subsequent technical annexes to the biennial update report containing results from REDD-plus[6] activities are voluntary and exclusively for the purpose of obtaining and receiving results-based payments, pursuant to decision 13/CP.19, paragraph 2, and decision 14/CP.19, paragraphs 7 and 8. This submission, therefore, does not modify, revise or adjust in any way the nationally appropriate mitigation actions currently being undertaken by Brazil under the Bali Action Plan,[7] or any nationally determined contribution undertaken by Brazil in the context of the Paris Agreement.

4. The objective of the TA is to assess the degree to which the information provided by Brazil is in accordance with the guidelines for submissions of information on reference levels[8] and to offer a facilitative, non-intrusive, technical exchange of information on the construction of the FREL with a view to supporting the capacity of Brazil for the construction and future improvement of its FREL, as appropriate.[9]

5. The TA of the FREL submitted by Brazil was undertaken in accordance with the guidelines and procedures for the TA of submissions from Parties on proposed FRELs and/or FRLs.[10] This report on the TA was prepared by the AT following the same guidelines and procedures.

6. Following the process set out in those guidelines and procedures, a draft version of this report was communicated to the Government of Brazil. The facilitative exchange during

[1] The submission of Brazil is available at http://unfccc.int/8414.
[2] Decision 13/CP.19, annex, paragraph 7.
[3] Decision 13/CP.19, annex, paragraphs 7 and 9.
[4] Decision 13/CP.19, annex, paragraph 9.
[5] Decision 1/CP.16, paragraph 71(b).
[6] In decision 1/CP.16, paragraph 70, the COP encouraged developing country Parties to contribute to mitigation actions in the forest sector by undertaking the following activities: reducing emissions from deforestation; reducing emissions from forest degradation; conservation of forest carbon stocks; sustainable management of forests; and enhancement of forest carbon stocks.
[7] See document FCCC/AWGLCA/2011/INF.1.
[8] Decision 12/CP.17, annex.
[9] Decision 13/CP.19, annex, paragraph 1(a) and (b).
[10] Decision 13/CP.19, annex.

the TA allowed Brazil to provide clarifications and additional information, which were considered by the AT in the preparation of this report.[11] As a result of the facilitative interactions with the AT during the TA, Brazil provided a modified version of its submission on 28 May 2018, which took into consideration the technical inputs of the AT. The modifications improved the clarity and transparency of the submitted FREL, without needing to alter the approach used to construct the proposed FREL. This technical assessment report (TAR) was prepared in the context of the modified FREL submission. The modified submission, containing the assessed FREL, and the original submission are available on the UNFCCC website.[12]

B. Proposed forest reference emission level

7. The subnational FREL proposed by Brazil is the second submission for the Amazonia biome, the first one addressing results-based payments for two periods: from 2006 to 2010 (FREL A) and from 2011 to 2015 (FREL B). In this second submission, a third FREL (FREL C) has been proposed as an update of FREL A and FREL B, based on a longer calibration period. FREL C has been proposed with the aim of accessing results-based payments for REDD-plus activities for the period 2016–2020 and has been constructed based on the annual average of carbon dioxide (CO_2) emissions associated with "gross deforestation" over the historical period 1996–2015. The FREL includes the emissions from deforestation associated with clear-cut areas of natural forest, assumes that the full carbon stock is lost at the time of clear-cutting and excludes any subsequent CO_2 emissions and removals from the clear-cut areas (i.e. it is for "gross deforestation"). The proposed FREL C presented in the modified submission corresponds to 751,780,503.37 tonnes of carbon dioxide equivalent per year (t CO_2 eq/year).

8. In decision 1/CP.16, paragraph 70, the COP encourages developing country Parties to contribute to mitigation actions in the forest sector by undertaking a number of activities, as deemed appropriate by each Party and in accordance with their respective capabilities and national circumstances, in the context of the provision of adequate and predictable support. The FREL proposed by Brazil, on a voluntary basis, for a TA in the context of results-based payments, covers the activity "reducing emissions from deforestation", which is one of the five activities included in decision 1/CP.16, paragraph 70. Pursuant to paragraph 71(b) of the same decision, Brazil developed a subnational FREL with the aim of transitioning to a national FREL in the near future, incorporating all biomes in the country. The proposed FREL covers the Amazonia biome.

9. The proposed FREL was calculated using the same methodology as the previous submission for the Amazonia biome. The National Institute for Space Research (INPE), through the Amazon Gross Deforestation Monitoring Project (PRODES), annually assesses gross deforestation in natural forests using satellite data. Emission factors (EFs) for the living biomass and litter pools are derived by applying an allometric equation to data collected by the RADAMBRASIL project[13] for 9 of the 22 distinct forest types addressed in the submission for the Amazonia biome, based on the Vegetation Map of Brazil from the Brazilian Institute for Geography and Statistics (IBGE). Information and EFs for 13 of the vegetation types that are present in the Amazonia biome that have not been sampled by the RADAMBRASIL project were derived from the literature and references consulted.

10. The proposed FREL includes the above-ground biomass, below-ground biomass and litter pools. Regarding greenhouse gases (GHGs), the submission includes CO_2.

[11] Decision 13/CP.19, annex, paragraphs 1(b), 13 and 14.

[12] http://unfccc.int/8414.

[13] The RADAMBRASIL project was conducted between 1970 and 1985 and covered the entire Brazilian territory (with a focus on Amazonia) using airborne radar sensors. The results from the RADAMBRASIL project included studies and thematic maps (covering geology, geomorphology, pedology, vegetation and potential land use, as well as assessment of natural renewable resources), which are still broadly used as a reference for the ecological zoning of the Brazilian Amazonia.

11. The annexes to the submission provided additional information on the PRODES project, the Action Plan for the Prevention and Control of Deforestation in the Legal Amazon (PPCDAm), examples to support the FREL submission, Forest Degradation in the Amazonia Biome and the plan to move from subnational FRELs to a national FREL. Brazil also included in the Info Hub files with all the calculations.[14]

II. Data, methodologies and procedures used in the construction of the proposed forest reference emission level

How each element in the annex to decision 12/CP.17 was taken into account in the construction of the forest reference emission level

1. Information that was used by the Party in the construction of the forest reference emission level

12. Brazil applied the Intergovernmental Panel on Climate Change (IPCC) methodology provided in the *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF) as a basis for estimating changes in carbon stocks in forest land converted to other land-use categories to construct its FREL for the Amazonia biome. This means that emissions from deforestation are estimated from 1996 onwards by combining activity data (AD) for the annual area of gross deforestation with the corresponding EFs for the forest types that were deforested. Brazil's estimates of emissions are of gross deforestation, and therefore do not include emissions or removals from subsequent land uses or activities.

13. The methods used by Brazil to construct FREL C are identical to those used to construct FRELs A and B, which were assessed in 2014.[15] FREL C has been estimated as the annual average of emissions from gross deforestation of natural forest in the Amazonia biome for the reference period 1996–2015 and, in doing so, updates the data underlying FREL A and FREL B. The AD used for the construction of the FREL for the Amazonia biome are based on INPE data on the historical time series for gross deforestation obtained from the PRODES project. The AD for gross deforestation are derived from Landsat-class satellite data that have been collected on an annual, wall-to-wall basis since 1988 and are spatially explicit, with a minimum mapping unit of 6.25 ha. Every year, the newly acquired images are analysed to identify new deforestation activity since the previous year, generating a deforestation map with spatially explicit (georeferenced) deforested polygons. The Landsat imagery was also used by the PRODES project to create a natural forest cover mask for the Amazonia biome in 1988. The IBGE Vegetation Map was also used as ancillary information to support the delimitation of the boundaries of the natural forest cover. In any one year, deforestation detected in areas that had been under cloud cover on previous mapping dates is distributed evenly across the previously cloud-covered years for each affected polygon. Brazil considers the PRODES project to be the most reliable source of deforestation AD because annually and wall-to-wall acquired deforestation data are used, rather than the data used in the production of the national inventories, which instead provide annualized averages from periodically mapped land-use classes. Brazil has not carried out any ground truthing of the deforestation polygons identified in the Amazonia biome owing to the distinctive signal in the satellite imagery from being forest land in one year and clear-cut (exposed soil) in the subsequent year.

14. A carbon map for the Amazonia biome was constructed to enable emissions to be estimated from the spatially defined deforested areas. The carbon densities embedded in the map originate from one of two main sources: (1) through the RADAMBRASIL project, from which radar and plot data (including circumference at breast height and height of all trees above 100 cm from 2,292 sample plots) were combined with an allometric equation

[14] Examples of files provided by Brazil in the Info Hub include Worksheet_FREL_C_2019.xls and guidance on the worksheet provided in Simple Guide_file_WORKSHEET_FREL_C_2019.xls to the Worksheet_FREL_C.xls.

[15] See document FCCC/TAR/2014/BRA.

developed in 1998 to estimate carbon stocks for the forest types sampled; or (2) by conducting a literature review for the forest types not sampled in the RADAMBRASIL project.

15. The deforestation map is then overlaid with the carbon map containing the carbon stocks associated with the distinct forest types in the Amazonia biome. Each deforestation polygon in a given image is associated with a "RADAMBRASIL volume", a forest type and its associated carbon stock. The same forest type may have a different carbon density depending on the RADAMBRASIL volume it falls under owing to variability in the soil types, climatic conditions and flood regime for riparian vegetation in the Amazonia biome. The carbon map used for FREL C is consistent with those used for the previous FRELs for the Amazonia biome and with the maps used in the GHG national inventory for the second national communication. Brazil has developed a new carbon map for the third national inventory, which has not been used in the construction of FREL C. Brazil provided a comparison in its modified submission, showing that the difference between the average annual CO_2 emissions calculated using the carbon maps of the second and third national inventories is 0.22 per cent when comparing the same carbon pools (living biomass and litter). The comparison is provided in table 8 of the modified submission.

2. Transparency, completeness, consistency and accuracy of the information used in the construction of the forest reference emission level

Methodological information, including description of data sets, approaches and methods

16. The Amazonia biome is one of six that make up the territory of Brazil, and corresponds to approximately 49 per cent of the national territory. Since its previous submission on the Amazonia biome, Brazil has made significant progress towards a national FREL by constructing and submitting a FREL for the Cerrado biome that, with the Amazonia biome, encompasses approximately 73 per cent of the Brazilian territory. The AT commends Brazil for continuing to work towards the construction of a national FREL.

17. The construction of FREL C for the Amazonia biome differs from FREL A and FREL B of the 2014 submission in that the calibration period has been extended from 1996–2010 to 1996–2015 and the data underlying the previous calibration estimates have been updated after adjusting for cloud cover with new AD obtained from the period 2011–2015.

18. The previous TAR identified differences in the area reported as deforested between the Amazonia biome and the Legal Amazon region. During the previous TA, Brazil clarified that the increments of adjusted deforestation in the Amazonia biome that had been used to construct FREL A and FREL B were greater than the deforestation rates reported for the Legal Amazon for the years 1996–2003 and 2005, even though the Amazonia biome is contained within the Legal Amazon, and explained that the differences arose from the use of different methodological approaches to estimating deforestation for each geographical region.[16] The AT observed the same inconsistency in the FREL C submission – the net difference of total deforested areas from 1995 to 2015 is 291,894 ha according to table A.2 in the modified submission. Brazil include an explanation for the methodological differences between the deforestation rates used for estimating the deforested areas in the Legal Amazon and the adjusted increments used for the FREL in the modified submission. The AT commends Brazil for the clarification, and recognizes that the difference of 1.05 per cent between the mean values of deforested areas is relatively small. Further, the AT notes that the inconsistency stems mainly from the data for the period 1996–2003, and would therefore be eliminated if Brazil were to improve the accuracy of the data by changing the calibration period to 2004 onward, as it plans to do for future FRELs (see para. 19 below).

19. In the previous TAR, the AT considered that the inconsistency identified between the deforestation estimates for the period 1996–2000, which are based on analogue maps, and the estimates derived from digital maps for 2001 onward was an area for future technical improvement.[17] In response to a question raised by the AT during the TA, Brazil explained that for future FREL calibration periods, the analogue maps for the period 1996–2000 would

[16] FCCC/TAR/2014/BRA, paragraphs 15 and 16.
[17] FCCC/TAR/2014/BRA, paragraph 17.

not be used, as the calibration period for the national FREL would most likely be from 2004 – the year in which the National Plan to Prevent and Control Deforestation was introduced – onward. The AT notes that excluding the earlier deforestation rates will reduce calibration period emissions. The AT commends Brazil for investigating options for improving the consistency and accuracy of the time series used to construct the FREL and reiterates the previous AT's finding that revising the calibration period for the national FREL to exclude the less accurate AD is an area for future technical improvement.

20. The 6.25 ha minimum mapping unit used by Brazil has been maintained for time-series consistency although, since 2008, deforestation detection is tracked to a 1 ha minimum area and included in the deforestation estimates when the smaller areas combined reach the 6.25 ha threshold. The previous AT encouraged Brazil to provide information on the extent of deforested areas that are detected at the 1 ha threshold but not retrieved later by the PRODES project using a 6.25 ha threshold, with the aim of showing that no significant deforestation is excluded from the FREL.[18] The AT reiterates the encouragement of the previous AT, noting that this information would enhance the transparency of future submissions.

21. Brazil adjusted its deforestation AD to correct for deforestation polygons detected in areas which were affected by cloud cover in previous years.[19] In the original submission, Brazil only adjusted the deforestation increments in the period 2011–2015, maintaining the same increment values for 1996–2010 as those used in Brazil's second biennial update report (which are the same as those used in the modified submission for FREL A and FREL B). During the assessment, the AT requested additional information on the unadjusted deforestation AD, which Brazil provided to the AT and also included in the modified submission. Brazil explained that the non-adjusted increments for deforestation for the period 2011–2015 totalled 2,524,231.36 ha, whereas the adjusted increments for the same period amounted to 2,479,670.42 ha, the difference thus being 44,560.94 ha. In the original submission for FREL C, this value was not distributed to years prior to 2011 in order to maintain consistency with Brazil's second biennial update report. As a result of the technical exchange with the AT, Brazil modified the submission to adjust the values for the period 1996–2010, incorporating the distribution of the increments and associated emissions from the analysis of the 2011–2015 data. This resulted in an increase of 44,561.12 ha in the total increment of deforestation in the period 1996–2010 and a decrease of 44,560.95 ha in the period 2011–2015 (see table 1 of the modified submission). The net change is 0.17 ha. Brazil also included unadjusted annual increments of deforestation in the modified submission (footnote 19) and prepared worksheets, with the corresponding data available on Brazil's Info Hub for REDD-plus.[20] The AT commends Brazil for including the additional information in the modified submission and notes that Brazil made the underlying spreadsheets publicly available, which enhances the transparency of the submission.

22. In the previous TAR, the AT noted that the emission estimates used in the construction of the FREL included both the emissions from deforestation (clear-cutting) and the emissions from forest degradation that occurred previously and acknowledged the complexities of separating the emissions between the two activities.[21] In its modified submission, Brazil specifies that the majority of deforestation, which occurs in the south and east of the Amazonia biome, occurs in lower carbon density forest types. The AT notes that the carbon densities applied to the majority of deforestation may have already taken account of previous forest degradation. In addition, if the majority of deforestation occurs in degraded forests, there is a risk of emissions leakage as these forests are lost. Forest degradation activities would have to shift to areas with biomass as the degraded forests, where degradation activities have traditionally been more prevalent, are converted to other land uses. These degradation activities, if they are ongoing, are likely to move into other forests, potentially with higher biomass. The AT notes that the results of Brazil's DEGRAD programme, which monitors forest degradation, and the data collected to date indicate that the level of forest degradation corresponds to the level of deforestation, so that when a decrease in emissions

[18] FCCC/TAR/2014/BRA, paragraph 18(a).
[19] FCCC/TAR/2014/BRA, paragraph 16.
[20] http://redd.mma.gov.br/pt/frel-c.
[21] FCCC/TAR/2014/BRA, paragraphs 18(b) and 30.

from deforestation occurs it is matched with a corresponding decreasing trend in emissions from forest degradation. This indicates that leakage may not be increasing with the reduction in deforestation. The AT commends Brazil for continuing to monitor both deforestation and forest degradation activities and for continuing to work on improving the method used to monitor forest degradation to ensure that when deforestation is reduced the impact on the level of forest degradation can be accurately tracked.

23. During the assessment, the AT requested additional information on EFs and vegetation types to assist it in understanding how the FREL was constructed. Brazil provided additional information to the AT which is reflected in the modified submission. RADAMBRASIL provided EFs for nine forest types, covering 85 per cent of the vegetation present in the Amazonia biome. For the other 13 forest types included, which represent 12 per cent of the vegetation present in the Amazonia biome, the EFs were retrieved through a literature review. The AT commends Brazil for providing information on the carbon densities and area of vegetation types within each RADAMBRASIL volume. Brazil also included information in the modified FREL submission explaining that some of the deforested area included in the FREL covered vegetation types that were not included in the 22 forest types. These five vegetation types cover less than 3 per cent of the vegetation present in the Amazonia biome. Brazil further explained that the contribution of these vegetation types to the deforestation increment and associated emissions is minor. The AT notes that information on how the EFs are derived for these five forest types has not been provided, and considers the provision of this information as an area for future technical improvement.

24. In creating the carbon map, Brazil excluded some RADAMBRASIL plots from the analysis. During the assessment, and in response to a question raised by the AT on whether the removal of plots could bias the sample, and therefore the representativeness of the analysis and related EFs, the Party provided an analysis, where possible, of the effect of the missing samples and found that there was no relevant impact on the average carbon stock per unit area across the Amazonia biome. In addition, a comparison made between the carbon map used for the second national communication and the new carbon map used for the third national communication, developed using different methods, found a small difference (1.66 per cent), mainly because of the different methodology applied in the construction of the carbon map used in the third national GHG inventory. The AT commends the Party for providing the additional analyses and agrees that the exclusion of the samples is justified.

25. During the assessment, the AT requested additional information in order to reconcile the AD between the FREL and Brazil's national GHG inventories. In its modified submission (box 2, pp.14–16) Brazil explains the difference between the deforested land included in the third national communication and that included in the FREL: emissions from all managed lands are included in the third national communication, whereas only emissions from the deforestation of previously intact natural forests are included in the FREL. Data from the PRODES project are used in the construction of the FREL, which have a different scale and a different vegetation cover from those used for the third national communication (see para. 36 below). The data reported in the national communications are not collected on an annual basis, may be differently affected by cloud cover and may use satellite data acquired on different dates from those collected by the PRODES project. Direct comparisons are therefore not possible. The AT commends Brazil for providing this additional information in the modified submission and recognizes the benefit of using data from various sources to construct the FREL and improve its accuracy, even if doing so leads to discrepancies between the FREL and the national GHG inventory.

26. The AT identified that the annual increment of deforested areas and areas under cloud cover provided in the FREL and the national GHG inventory of the third national communication are different. For example, the information on deforested areas in unmanaged forests and managed forests provided in the GHG inventory of the third national communication for the years 2005–2010 was 4.3 million ha larger than in the FREL for the same period. A similar difference in cloud cover areas was also identified. Brazil explained that different methodologies were used in those two documents for the identification of areas, which led to the differences identified. The AT considers that providing a territorial matrix of the Amazonia biome in the FREL with the distribution considered by the national communication and by the FREL, along with a clear description of any methodological

differences, would enhance the transparency of future submissions and notes this as an area for future technical improvement.

27. The AT noted that tables I, II, III, IV and V of Brazil's third national communication (vol. III, appendix I) also report AD collected by the PRODES project, which is the same source as that used in the construction of the FREL. In a detailed comparison for the Amazonia biome and the years 1998–2002, the AT found differences between the PRODES deforestation increments included in the third national communication and those included in the FREL. In the third national communication, the AT took the deforested areas as of 1997 (table II) and subtracted them from the accumulated deforested area for 1997–2002 (table III). The resulting deforestation increment for five years amounts to 53,051,389.8 ha – 38,209,196.2 ha = 14,842,193.6 ha. In comparison, the PRODES deforestation increments for the same five-year period taken from table A.2 of the modified FREL submission amount to 9,268,400 ha. The AT notes that the difference between the PRODES deforestation increments in the third national communication and in the FREL is 5,573,793.6 ha, and that Brazil did not provide a clear explanation for this difference. The AT considers that better explaining such differences would improve the consistency and transparency of the FREL, and notes the provision of such explanations as an area for future technical improvement.

28. The AT notes that Brazil is implementing its national forest inventory (NFI) (details and current progress are provided in the modified FREL submission). In the Amazonia biome, the work started in 2014 and data have already been collected in 1,100 conglomerates. The analysis of the collected data is in process and hence could not be used in the 2018 submission. Brazil expects that the NFI data will be instrumental for the construction of the national FREL. The AT considers that the NFI is the most significant source of AD, EFs and carbon maps for validation and will increase the accuracy of future FREL submissions.

29. During the assessment, the AT found inconsistencies in the data tables, which Brazil corrected in the modified submission. The AT commends Brazil for addressing the inconsistencies. The AT recognizes the significant number of operations carried out to estimate the FREL and considers that strengthening the quality control of the submission will lead to the elimination of inconsistencies.

Description of relevant policies and plans, as appropriate

30. The proposed FREL is based on historical data and no assumptions regarding future changes to domestic policies have been included in the construction of FREL C. The submission contains a description of PPCDAm in annex I, section 2. PPCDAm is in its fourth phase (2016–2020), having been created in 2004.

3. Pools, gases and activities included in the construction of the forest reference emission level

31. According to decision 12/CP.17, annex, subparagraph (c), reasons for omitting a pool and/or activity from the construction of the FREL should be provided, noting that significant pools and/or activities should not be excluded.

32. The pools included in the FREL are living biomass (above- and below-ground biomass) and litter. The deadwood and soil organic carbon pools were not included. The previous AT considered that the exclusion of the soil organic carbon pool was adequately justified on the basis of the state of knowledge at the time and considered that the inclusion of the deadwood pool was possible, as tier 1 defaults are available in the IPCC good practice guidance for LULUCF (table 3.2.2). The previous AT considered both cases as areas for future technical improvement. Since the publication of FRELs A and B and the 2014 TAR, Brazil has submitted its third national communication, in which both the deadwood and soil organic carbon pools are reported for the first time. During the TA, the AT concluded that the omission of the soil organic matter pool in FREL C has been adequately justified. In the view of the AT, the omission of emissions from the deadwood and soil organic carbon pools in FREL C, which is based solely on the reduction of emissions from gross deforestation, is conservative for reporting on REDD-plus activities. The AT accepts Brazil's approach to include these pools in the national FREL when the Party considers it more appropriate.

33. The FREL includes CO_2 emissions. Non-CO_2 gases are excluded. Brazil explained that there is a need to better understand the use of fire associated with deforestation in the Amazonia biome as different practices occur in the Amazonia biome compared with the Cerrado biome. If data allow, Brazil will include non-CO_2 gases in the Amazonia FREL that will feed into the national FREL. The same rationale will apply to the other biomes. The AT commends Brazil for continuing to work on this matter and notes it as an area for future technical improvement.

34. The AT acknowledges that Brazil has included the most significant activity ("reducing emissions from deforestation") of the five activities identified in decision 1/CP.16, paragraph 70, in accordance with its national capabilities and circumstances. Brazil reported in its 2018 submission on progress made with regard to forest degradation since its 2014 submission. The AT commends Brazil for the information provided in annex III to its submission. In response to a question from the AT, Brazil explained that, at present, it is concentrating its efforts in the most significant REDD-plus activity (i.e. "reducing emissions from deforestation"). Brazil informed the AT that it is considering including another activity, "reducing emissions from forest degradation", in its national FREL, planned for 2020, owing to the significance of forest degradation on the emissions from forests, particularly in Amazonia. The AT acknowledges Brazil's intention to include emissions from forest degradation in its national FREL, planned for 2020, and notes this as an area for future technical improvement.

35. The AT notes that other activities could also be significant, in particular "enhancement of forest carbon stocks". According to Brazil, it is concentrating on natural forests only and is therefore not prioritizing the consideration of the enhancement of forest carbon stocks through, for instance, the establishment of new forests. Brazil informed the AT that progress on other REDD-plus activities will depend, besides data availability, on the level of results-based payments received through current REDD-plus activities. Therefore, the AT notes that the current exclusion of the activity "enhancement of forest carbon stocks" from the FREL is justified as there are challenges in assessing forest carbon stocks in a cost-effective manner. The AT acknowledges Brazil's national circumstances.

4. Definition of forest

36. Brazil provided in its submission the definition of forest used in the construction of its FREL, consistent with its former submission of a FREL for the Amazonia biome.[22] Based on a discussion with the AT on the application of the forest definition, Brazil included additional explanations of the forest definition in box 10 of the modified submission. For the FREL, the PRODES "forest mask" is used as a basis, which was created to map the dense, mostly continuous, natural tropical high forests within which deforestation in the Amazonia biome is detected. The forest definition of the Food and Agriculture Organization of the United Nations (FAO) sets thresholds that are not appropriate for characterizing deforestation in natural tropical forests, since the definition includes a type of cover that could never be classified as forest in Amazonia. Brazil's report to FAO includes transition zones as part of forest (e.g. transition between savannah and steppe savannah, transition between steppe savannah and seasonal forests), most of which are not considered forest for the purpose of PRODES. The same occurs in the delimitation of forest in the second and third national inventories. The AT notes that the forest definition applied for the FREL submissions appears to be different from that used for other reports, because the FREL with the activity "reducing emissions from deforestation" includes only clear-cut areas of natural forests.

III. Conclusions

37. The information used by Brazil in constructing its FREL for the activity "reducing emissions from deforestation" is transparent and complete and in overall accordance with the guidelines for submissions of information on reference levels (as contained in the annex to decision 12/CP.17).

[22] FCCC/TAR/2014/BRA, paragraph 32.

38. The FREL presented in the modified submission, for the reference period 1996–2015, corresponds to 751,780,503.37 t CO_2 eq/year.

39. The AT acknowledges that Brazil included in the FREL the most significant activity, the most important biome and the most significant pools in terms of emissions from forests. In doing so, the AT considers that Brazil followed decision 1/CP.16, paragraph 70, on activities undertaken, and paragraph 71(b), on elaboration of a subnational FREL as an interim measure, and decision 12/CP.17, paragraph 10, on implementing a stepwise approach. The AT commends Brazil for the information provided on the ongoing work on the development of FRELs for other activities, in particular "reducing emissions from forest degradation", as well as for other biomes, as steps towards a national-level FREL.

40. As a result of the facilitative interactions with the AT during the TA, Brazil provided a modified submission, which took into consideration the technical inputs of the AT. The AT notes that the transparency and completeness of information was improved significantly in the modified FREL submission without the need to alter the approach used to construct the FREL, and commends Brazil for the efforts made. The new information provided in the modified submission, including through the data made available online[23] and the examples of how the estimates of CO_2 emissions from deforestation were calculated, increased the reproducibility of the FREL calculations.

41. Pursuant to decision 13/CP.19, annex, paragraph 3, the AT identified the following areas for future technical improvement:

(a) Exclude the less accurate AD (see para. 19 above) 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 the PRODES project using a 6.25 ha threshold, with the aim of showing that no significant deforestation is excluded from the FREL (see para. 20 above);

(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 para. 23 above);

(d) Provide a territorial matrix of the Amazonia biome in the FREL with the distribution considered by the national communication and by the FREL, along with a clear description of any methodological differences (see para. 26 above);

(e) Better explain the difference of 5,573,793.6 ha between the PRODES deforestation increments in the third national communication and in the FREL (see para. 27 above);

(f) Strengthen the quality control of the submission to eliminate inconsistencies (see para. 29 above).

42. In assessing the pools and gases included in the FREL, in accordance with decision 13/CP.19, annex, paragraph 2(f), the AT notes that the current omission of pools and gases is likely to be conservative in the context of the FREL. Nevertheless, the AT identified the following additional areas for future technical improvement:

(a) Include non-CO_2 gases to improve consistency with the GHG inventory included in the national communication (see para. 33 above).

43. The AT acknowledges and welcomes the intention expressed by Brazil to:

(a) Extend the FREL to the other biomes, as part of efforts to move towards a national FREL (see para. 16 above);

(b) Continue to seek to estimate emissions from forest degradation so as not to exclude emissions from significant sources and include emissions from forest degradation in future FREL submissions when new, adequate data and better information become available (see para. 22 above);

[23] See http://redd.mma.gov.br/pt/frel-c.

(c) Complete the NFI and use the results to improve the EFs for the construction of a national FREL (see para. 28 above).

44. In conclusion, the AT commends Brazil for showing a strong commitment to the continuous improvement of its FREL estimates, in line with the stepwise approach. A few areas for future technical improvement of Brazil's FREL have been identified in this report. At the same time, the AT acknowledges that such improvements are subject to national capabilities and policies, and notes the importance of adequate and predictable support.[24] The AT also acknowledges that the assessment process was an opportunity for a rich, open, facilitative and constructive technical exchange of information with Brazil.

45. The table contained in the annex summarizes the main characteristics of Brazil's proposed FREL.

[24] Decision 13/CP.19, annex, paragraph 1(b), and decision 12/CP.17, paragraph 10.

Annex

Summary of the main features of the proposed forest reference emission level based on information provided by Brazil

Main features of the FREL		*Remarks*
Proposed FREL (in t CO_2 eq/year)	751 780 503.37	FREL C for the Amazonia biome is presented by Brazil with the aim of accessing results-based payments for REDD-plus activities for the period 2016–2020 (see para. 7 of this document)
Type and duration of FREL	FREL = historical emissions for the period 1996–2015	The FREL is constructed based on the annual average of the CO_2 emissions associated with "gross deforestation" over the historical period 1996–2015 (see para. 7 of this document)
Adjustment for national circumstances	No	–
National/subnational	Subnational	Pursuant to paragraph 71(b) of decision 1/CP.16, Brazil developed a subnational FREL with the aim of transitioning to a national FREL in the future, incorporating all biomes in the country. The proposed FREL covers the Amazonia biome (see para. 8 of this document)
Activities included	Reducing emissions from deforestation	Brazil has included the most significant activity ("reducing emissions from deforestation") of the five activities identified in decision 1/CP.16, paragraph 70, in accordance with its national capabilities and circumstances (see paras. 34 and 35 of this document)
Pools included	AB, BB and litter	The deadwood and soil organic carbon pools were not included. In the assessment team's view, the omission of emissions from the deadwood and soil organic carbon pools from FREL C, which is based only on the reduction of gross deforestation emissions, is conservative for reporting on REDD-plus activities (see para. 32 of this document)
Gases included	CO_2	Non-CO_2 gases are excluded. Brazil clarified that to enable the inclusion of non-CO_2 gases in the FREL there is a need to better understand the use of fire associated with deforestation in the Amazonia biome (see para. 33 of this document)
Forest definition	Included	The forest definition provided in the FREL is the definition used for GHG inventories and for reporting to the Food and Agriculture Organization of the United Nations, but Brazil does not apply all the same vegetation typologies for the FREL. Deforestation of the Amazonia biome is not associated with the definitional thresholds used for the Party's other reporting, but only with clear-cut activities where the canopy cover is zero (see para. 36 of this document)
Relationship with latest GHG inventory	The methods used for the FREL are not	Overall, FREL C, as an actualization of FREL A and B, maintains consistency, in terms of

Main features of the FREL		*Remarks*
	consistent with the latest GHG inventory (2016)	sources of activity data and emission factors, with the GHG inventory included in Brazil's second national communication and first and second biennial update reports. Inconsistencies identified by the AT between the FREL and the third national GHGs inventory are based on the use of different data for the FREL and are justifiable (see paras. 25 and 26 of this document)
Description of relevant policies and plans	Included	The submission (annex I, section 2) contains a description of Brazil's Action Plan for the Prevention and Control of Deforestation in the Legal Amazon (see para. 30 of this document)
Description of assumptions on future changes in policies	Not applicable	–
Descriptions of changes to previous FREL	Not applicable	–
Future improvements identified	Yes	A few areas for future technical improvement were identified such as: complete the national forest inventory and use the results to improve the emission factors; monitor forest degradation; and ensure consistency of activity data and emission factors with the latest version of national communications (see paras. 41–43 of this document)

Abbreviations: AB = above-ground biomass, BB = below-ground biomass, FREL = forest reference emission level, GHG = greenhouse gas.