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Report on the technical assessment of the proposed forest reference emission level of Paraguay submitted in 2016

Summary

This report covers the technical assessment of the submission of Paraguay, on a voluntary basis, 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 Paraguay covers the activity "reducing emissions from deforestation", which is among the activities included in decision 1/CP.16, paragraph 70. In its submission, Paraguay has developed a national FREL. The assessment team notes that the data and information used by Paraguay in constructing its FREL are transparent and complete, and are 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 further technical improvement, according to the scope of the technical assessment in the annex to decision 13/CP.19.

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Contents

I. Introduction and summary

A. Overview

1. This report covers the technical assessment (TA) of the submission of Paraguay on its proposed forest reference emission level (FREL),[1] submitted on 4 January 2016 in accordance with decisions 12/CP.17 and 13/CP.19. The TA took place as a centralized activity from 14 to 18 March 2016 in Bonn, Germany, and was coordinated by the 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)): Mr. Raúl Abad Viñas (Spain) and Mr. José María Michel Fuentes (Mexico). In addition, Mr. Kamel Djemouai, 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.

2. In response to the invitation by the Conference of the Parties (COP) and in accordance with the provisions of decision 12/CP.17, paragraphs 7–15, and its annex, Paraguay 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 or forest reference level (FRL), 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. Paraguay provided its submission in Spanish. The original submission was supported by four annexes, also in Spanish, to enhance its transparency. The annexes contained the following additional information: a methodological description of the elaboration of the 2011 forest cover map, the 2011 palm cover map and land-use change maps (annex I); the methodology used to assess the uncertainty and accuracy associated with land-use change maps (annex II); a field manual for collecting data for the national forest inventory (annex III); and data processing for the national forest inventory (annex IV).

4. The objective of this TA was to assess the degree to which information provided by Paraguay was in accordance with the guidelines for submissions of information on FRELs and FRLs[6] 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 Paraguay for the construction and future improvement of FRELs, as appropriate.[7]

5. The TA of the FREL submitted by Paraguay was undertaken in accordance with the guidelines and procedures for the TA of submissions from Parties on proposed FRELs and/or FRLs as contained in the annex to decision 13/CP.19. This report on the TA was prepared by the AT following the guidelines and procedures in the same decision.

6. Following the process contained in the guidelines and procedures of the same decision, a draft version of this report was communicated to the Government of Paraguay.

[1] The submission of Paraguay can be found 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] Decision 12/CP.17, annex.
[7] Decision 13/CP.19, annex, paragraph 1(a) and (b).

The facilitative exchange during the TA allowed Paraguay to provide clarifications and information that were considered by the AT in the preparation of this report.[8] As a result of the facilitative interactions with the AT during the TA session, Paraguay submitted a modified version in Spanish with six annexes on 9 May 2016, which took into consideration the technical inputs by the AT. The modifications improved the clarity and transparency of the submitted FREL and resulted in a modification of the FREL originally proposed. This TA report was prepared based on the context of the modified FREL submission. The modified submission that contains the assessed FREL and the original submission are available on the UNFCCC website.[9]

B. Proposed forest reference emission level

7. The national FREL proposed by Paraguay for the historical reference period 2000–2015[10] is the annual average of the carbon dioxide (CO_2) emissions associated with deforestation, defined as the conversion of native forest to other land-use categories. The FREL includes only the emissions from deforestation that are associated with native forest cover loss and excludes any subsequent emissions and removals from the deforested areas (gross deforestation). The proposed FREL includes native forest and excludes the conversion of forest plantations to other land-use categories. The information on activity data used in constructing the FREL was derived from two land-use change maps[11] developed by the National Forest Institute with the support of the United Nations collaborative programme on reducing emissions from deforestation and forest degradation in developing countries UN-REDD National Joint Programme. The information on emission factors was obtained from Paraguay's national forest inventory. The information used to derive the carbon stock in trees and in understory vegetation was collected from 121 and 99 sample units, respectively, during the period 2014–2015. The FREL presented in the modified submission with the aim of accessing results-based payments for REDD-plus[12] activities from 2016 onwards corresponds to 58,763,376.14 tonnes of carbon dioxide equivalent per year (t CO_2 eq/year).[13]

8. In decision 1/CP.16 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 Paraguay on a voluntary basis for a TA in the context of results-based

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

[9] <http://unfccc.int/8414>.

[10] The choice of this period is justified on the basis of national circumstances, taking into consideration that the years before 2000 would include patterns that are not representative of future emissions.

[11] These maps cover the periods 2000–2011 and 2011–2015 by assessing deforested areas in 2000, 2005 and 2011 as represented in the first land-use change map, and in 2011, 2013 and 2015 as represented in the second land-use change map.

[12] In decision 1/CP.16, paragraph 70, the COP encourages 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.

[13] In its original submission, Paraguay proposed a national FREL of 60,388,964.99 t CO_2 eq/year for the period 2000–2015. The difference between the original and the modified submission is mostly due to the inclusion of updated information resulting from data processing of new sample units and to a reassessment of deforested areas as derived from the land-use change maps. In the modified submission, total deforested areas for the period 2000–2015 (table 1 of the modified submission) decreased by 500,717.73 hectares (ha) compared with the total deforested areas provided in the original submission.

payments covers the activity "reducing emissions from deforestation", which is one of the five activities included in paragraph 70 of decision 1/CP.16. Pursuant to paragraph 71(b) of the same decision, Paraguay has developed a national FREL covering all land with native forests for the entire national territory. Paraguay underlined that its submission does not prejudge any national contribution that the country may undertake in the context of the ongoing negotiation processes under the Convention. In its submission, Paraguay applies a stepwise approach to the development of the FREL, in accordance with decision 12/CP.17, paragraph 10. The stepwise approach enables Parties to improve the FREL by incorporating better data, improved methodologies and, where appropriate, additional pools.

9. The proposed FREL includes the pools above-ground biomass and below-ground biomass of trees, as well as the above-ground biomass of the understory vegetation, while the pools litter, dead wood and soil organic carbon in mineral and organic soils are not included. With regard to greenhouse gases (GHGs), the submission includes only emissions of CO_2.

10. The annexes to the modified submission were not subject to the TA but they provided useful information that clarified some of the technical issues and increased the transparency of the submission. The six annexes to the modified submission contain the following additional information: a methodological description of the elaboration of the 2011 forest cover map, the 2011 palm cover map and land-use change maps (annex I); the methodology used to assess the uncertainty and accuracy associated with land-use change maps (annex II); a field manual for collecting data for the national forest inventory (annex III); data processing for the national forest inventory (annex IV); preliminary information on soil and other carbon pools collected for the national forest inventory (annex V); and reference information from other data sources on "Bosque Sub Húmedo Inundable del Río Paraguay" and "Bosque Palmar" (annex VI).

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

11. For the construction of the national FREL, Paraguay used the methodology provided in the Intergovernmental Panel on Climate Change (IPCC) *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 stock from the conversion of forest land to other land-use categories.[14] Accordingly, the gross emissions from deforestation were estimated for the period 2000–2015 by combining activity data (i.e. areas of annual native forest deforestation) with the appropriate emission factors (i.e. CO_2 emissions associated with the corresponding forest strata).

12. The activity data used in the construction of Paraguay's FREL were based on two land-use change maps covering the periods 2000–2011 and 2011–2015,[15] generated by

[14] The *2006 IPCC Guidelines for National Greenhouse Gas Inventories* was also used for the selection of the default value of carbon fraction of forest biomass (i.e. 0.47).

[15] These two land-use change maps provide areas of deforestation in 2000, 2005 and 2011 as represented in the first land-use change map, and in 2011, 2013 and 2015 as represented in the second land-use change map.

using object-based image analysis (OBIA) methodologies with Landsat 5 and 8 images[16] with minimum mapping units of 1 hectare (ha) using the online platform Google Earth Engine. These maps provided information on forest cover changes by classifying the land as stable forest, stable non-forest and forest cover change.[17] Any loss of forest areas in a given period is considered deforestation.

13. The basis for generating the two land-use change maps was a forest cover map elaborated for 2011 by using supervised digital image classification, and based on a composite of selected cloud-free (cloud cover lower than 10 per cent) Landsat 5 Thematic Mapper (TM) images (TM3, TM4, TM5). At first, forest areas represented in the 2011 forest cover map included forest plantations and excluded palm areas. An independent map representing palm areas was generated for 2011 by using a similar methodology and this was added by geoprocessing to the forest cover map in a subsequent step. Likewise, by geoprocessing, forest plantation areas were subtracted from the original forest cover map in order to generate the final version of this map which, in line with the forest definition, included the following forest strata: "Bosque Húmedo de la Región Oriental", "Bosque Sub Húmedo del Cerrado", "Bosque Sub Húmedo Inundable del Río Paraguay", "Bosque Seco Chaqueño" and "Bosque de Palmar".

14. In response to a technical input by the AT, Paraguay clarified that the delineation of palm areas during the elaboration of the original 2011 forest cover map was not carried out because of difficulties in mapping the areas with low densities owing to the resolution of the images used. As a result, in order to ensure consistency with the forest definition, a specific map for these areas was elaborated, based on the expert judgement of experienced image interpreters, and the palm areas were then included in the final 2011 forest cover map that was used as the basis for the elaboration of the land-use change maps.

15. In response to a request by the AT to ensure greater transparency, Paraguay included in the modified submission a table with information on the annual deforested areas for four forest strata.[18] The AT commends Paraguay for including this information, which provided useful input to the reconstruction of the FREL and helped to enhance the completeness of the submission. Paraguay explained that the choice of the period in which deforestation was assessed was based on the need to provide information for the GHG inventory,[19] which covers the period 2005–2011 and that, for the purpose of the FREL submission, it was decided to extend that period back to 2000 and forward to 2015. The AT noted that, for those periods for which the annual deforested area represents an average value calculated over a period of four years or more, the result could lead to an underestimation or overestimation of the deforested area for any specific year included in the FREL.

[16] See tables 15 and 16 of the modified submission where the dates and further information on the images are presented.

[17] Stable forest refers to lands that were classified as forests in the initial period considered (2000) and have not changed in subsequent periods. Stable non-forest refers to lands that were classified as non-forest in the same period and have not changed in subsequent periods. Forest cover change refers to the difference between the forest area observed in the initial period and that observed at the end of the period. Initial and final refer to each of the assessed years. The first land-use change map assessed the areas for the years 2000, 2005 and 2011; the second land-use change map assessed the areas for the years 2011, 2013 and 2015.

[18] Palm areas are considered in the assessment of deforestation; however, this forest stratum is not represented in spatially explicit form in the land-use change maps but is included within the forest stratum "Bosque Sub Húmedo Inundable del Río Paraguay". As a result, tables 1 and 2 of the modified submission do not provide specific information on deforested areas for this forest stratum.

[19] The GHG inventory is included as part of the first biennial update report (BUR) submitted by Paraguay in 2015.

16. With regard to the emission factors, table 6 of the modified submission provides the carbon stock in each of the five forest strata disaggregated into above-ground biomass, below-ground biomass, total biomass and understory vegetation. The biomass stock of tree vegetation was estimated by combining individual tree dasometric information (diameter at breast height and height) from the national forest inventory, with allometric equations[20] that were selected for each forest stratum. Allometric equations were used to derive information on above-ground biomass and total biomass at the level of forest strata. For those forest strata for which only above-ground biomass equations were available Paraguay used biomass expansion factors to derive total biomass. Below-ground biomass was derived by subtracting the result of above-ground biomass from the total biomass. Through these methods, the biomass stock on each of these carbon pools is estimated at the level of sample units, and then averaged to derive the information on each forest stratum. The default value provided by the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* of 0.47 t C/t dry matter was used to derive the carbon stock, and then multiplied by 44/12 to obtain the values for CO_2 emissions. Regarding understory vegetation, biomass stock was estimated using the wet weight of all the biomass collected in subplots of 2 x 2 m, to which is applied a reduction factor calculated as the ratio of dry and wet weights of subsamples analysed in the laboratory. Then, to derive the carbon content of dry matter, a carbon fraction derived from the analysis of the subsamples using the combustion method was applied.

17. In the original submission dasometric information collected for the national forest inventory for the forest stratum "Bosque de Palmar" was not used. Paraguay assigned the emission factors estimated for the forest stratum "Bosque Sub Húmedo Inundable del Río Paraguay" to the deforested palm areas explaining that palm areas are not allocated in a spatially explicit form (see footnote 18 above), and that both forest strata are jointly distributed over the territory. The AT noted that this fact may result in an overestimation of emissions from "Bosque Sub Húmedo Inundable del Río Paraguay" because lower loss of biomass is expected when palm vegetation is deforested compared with the rest of the vegetation present in the "Bosque Sub Húmedo Inundable del Río Paraguay". In the modified submission, Paraguay estimated the emission factors for the forest strata "Bosque Sub Húmedo Inundable del Río Paraguay" as a weighted average, by area,[21] of the emission factors estimated for "Bosque Sub Húmedo Inundable del Río Paraguay" and "Bosque de Palmar" using the dasometric information available independently for each of the forest strata, and acknowledged that this is an area for future improvement.

18. Dasometric information on trees and understory vegetation was collected over 121[22] and 99[23] sample units, respectively, over the period 2014–2015. Information for "Bosque Húmedo de la Región Oriental" was collected on 45 sample units, for "Bosque Seco Chaqueño" on 39 sample units, for "Bosque Sub Húmedo del Cerrado" on 30 sample units, for "Bosque Sub Húmedo Inundable del Río Paraguay" on 4 sample units and for "Bosque de Palmar" on 3 sample units. In accordance with the information provided in the FREL submission, with the exception of the forest stratum "Bosque Húmedo de la Región Oriental", the information available for all the other forest strata is considered as

[20] Table 21 of the modified submission provides information on the allometric equations that were used at the level of forest strata.

[21] Paraguay calculated that 36 per cent of the area originally calculated for "Bosque Sub Húmedo Inundable del Río Paraguay" is occupied by palm forests.

[22] Three plots per sample unit were used under the forest strata "Bosque Seco Chaqueño" and "Bosque de Palmar".

[23] There is a different number of sample units used for the collection of information on trees and understory vegetation because not all the sample units used for the collection of information on trees for "Bosque Seco Chaqueño" and "Bosque Sub Húmedo del Cerrado" were suitable for the collection of information on understory vegetation.

preliminary. The total carbon stock in the five forest strata ranged from 19.85 t C/ha to 92.69 t C/ha. The AT agrees with these values, which are consistent with the default values provided in the IPCC good practice guidance for LULUCF, and commends Paraguay for the information provided on the plan for the future inclusion of additional information from more sample units as part of the stepwise approach. However, the AT considers that, owing to the extension and variety of the forests, some forest strata may be underrepresented leading to an overestimation or underestimation of the carbon stock.

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

19. The construction of Paraguay's FREL was based on the historical average of annual emissions of CO_2 from deforestation in the period 2000–2015, with the activity data being derived from two land-use change maps and emission factors estimated from dasometric information and allometric equations (see paras. 12–18 above). The AT noted that making all the information used in the construction of the FREL publicly available will improve the transparency and completeness of the submissions by allowing the reconstruction of the FREL. In response to a request by the AT, Paraguay stated that all the information on data and methods used for the submission of the FREL will be made available in a publicly accessible web platform.[24]

20. Paragraph 2(a) of the annex to the decision 13/CP.19 indicates that the TA of the proposed FREL should assess the extent to which the FREL maintains consistency with corresponding anthropogenic forest-related GHG emissions by sources and removal by sinks as contained in the national GHG inventories. The AT noted that the information on GHG emissions provided in the GHG inventory included in the latest biennial update report (BUR) (2015) is not fully consistent with the information used in the construction of the FREL, in particular for the year 2011, and in terms of carbon pools and gases included. Paraguay clarified that at the time of the submission of the BUR only a preliminary version of the land-use change maps was available, and that, while preliminary information from the national forest inventory was used to derive emissions from deforestation in the construction of the FREL, such information for two forest strata was not available at the time of the preparation of the BUR; therefore, default emission factors provided by the IPCC good practice guidance for LULUCF were used for these two forest strata. Furthermore, Paraguay clarified that while in the FREL submission only CO_2 emissions from gross deforestation are considered, the information contained in the BUR took into account CO_2 removals from one year's growth after the conversion of forest land to cropland. With regard to the inclusion of carbon stock changes and nitrous oxide (N_2O) emissions from soils in the BUR and their omission from the FREL, Paraguay clarified that this difference responds to an institutional decision that was taken during the preparation of the FREL submission, based on the need to prioritize above-ground and below-ground biomass carbon pools as these emissions were considered to be more accurate considering the available data. Moreover, N_2O emissions from soils were considered of low relevance compared with CO_2 emissions. The AT commends Paraguay for including this information in the modified submission, and considers that the consistency of the information provided among the documents should be an area of future improvements pursuant to a stepwise approach in order to address the consistency requirement set by the above-mentioned decision.

[24] During the TA, Paraguay provided the AT with information that allowed the reconstruction of the FREL, and included in the modified submission of the FREL a link to the web platform where all these documents were made publicly available; see <http://www.infona.gov.py/index.php/604>.

21. In assessing the extent to which the information used in the construction of the FREL is consistent with the information submitted to other international organizations, the AT noted that the definition of forest provided in the 2015 forest resources assessment[25] report submitted by Paraguay differs from the forest definition used in the construction of the FREL. Paraguay informed the AT that the forest definitions used in these documents are also different from the forest definition used in reporting under the Kyoto Protocol for clean development mechanism purposes. Paraguay explained that the reason for the use of different forest definitions is that several institutions are involved in the elaboration of each report, and the different moments in time when they were established. The AT understands the reason and commends Paraguay for its plan to implement efforts on the future use of a forest definition agreed by all the institutions.

22. The AT sought clarification on how the forest stratum "Bosque Sub Húmedo Inundable del Río Paraguay", which is present in both the east and the west regions, is considered when analysing satellite images, noting that the forest definition used[26] considers two different forest-cover thresholds depending on the region in which the vegetation is presented (10 per cent in the west region and 30 per cent in the east region). During the TA week, Paraguay acknowledged that, owing to the medium-resolution satellite images used and technical constraints during the photo-interpretation of the images, in practice only areas with a minimum forest cover of 30 per cent (20–40 per cent) can be unequivocally identified, and therefore this was the forest cover threshold used when elaborating the 2011 forest cover map and the land-use change maps. As a result of the technical exchange of information Paraguay has included in the modified submission a transparent description of the procedures carried out to elaborate the maps and explaining that, in practice, the 30 per cent forest cover threshold was implemented to assess deforestation. The AT commends Paraguay for including in the modified submission more detailed information that has enhanced the transparency, and at the same time, as acknowledged by Paraguay, the AT considers that the analysis of the deforested areas in line with the forest definition is an area for future improvement in the context of its stepwise approach.

23. The AT sought more clarification on how palm areas, included as native forest according to the forest definition, are treated in the construction of the FREL. Specifically, it noted that while the national forest inventory considers this forest type as an independent forest stratum, for which dasometric information is available, the original FREL submission did not consider palm areas as an independent forest stratum. Paraguay clarified that, although palm areas were considered in assessing deforestation in the FREL, they are not defined in a spatially explicit form in the land-use change maps but they were included as part of the forest stratum "Bosque Sub Húmedo Inundable del Río Paraguay" where most of the palm vegetation is situated. Furthermore, Paraguay stated that the available information, collected over three sample units, is considered not reliable enough because it was collected in a small area that does not fully represent the high variability of this forest type. In the modified submission, Paraguay has applied a weighted average by area of the emission factors estimated independently for these two forest strata, which was multiplied by deforested areas estimated for "Bosque Sub Húmedo Inundable del Río Paraguay" to derive the CO_2 emissions from deforestation in this forest stratum. Paraguay acknowledged that a future version of the forest cover map and land-use change maps would need to treat

[25] Available at <http://www.fao.org/3/a-az304s.pdf>.

[26] Native forest is defined for the purposes of the FREL submission as a natural ecosystem with biodiversity, managed or not, regenerated and/or restored naturally or by forestry techniques with native species that provide goods, and environmental and social services; and with a minimum area of 1 ha, with a height equal to or higher than 3 m in the west region and 5 m in the east region and which reaches a minimum forest cover in its natural state of 10 per cent in the west region and 30 per cent in the east region. This also includes native palms and bamboo that reach these thresholds.

these areas in a more consistent way. The AT regards this as an interim solution, but considers that the treatment of palm areas as an independent forest stratum, in terms of activity data and emission factors, would enhance the accuracy of the estimates, avoiding the potential overestimation of emissions, and therefore this is an area for future technical improvements.

24. As a result of the technical exchange of information between Paraguay and the AT, Paraguay has improved the transparency and completeness of the submission by incorporating more detailed information on the data and methods used in the construction of the FREL, and by including information derived from scientific and academic studies[27] on carbon stock in those forest strata for which the emission factors used in the construction of the FREL were derived from a lower number of sample units. The AT commends Paraguay for the inclusion of this information, which contributed to building confidence in the estimates used for the construction of the FREL. The AT noted that the allometric equations used to derive total and above-ground biomass of trees were selected at the level of forest strata, while a large variety of species are described in the submission at the level of each forest stratum, therefore leading to a potential overestimation or underestimation of the biomass stock. The AT further considers that Paraguay could make use of the geometric volume, estimated at tree level in the context of the national forest inventory from dasometric information, to derive biomass carbon stock that could serve to compare carbon stock used in the construction of the FREL and enhance the confidence in the estimated emissions.

25. The AT notes that the modified submission considerably improved the transparency, completeness and accuracy of the FREL. Furthermore, the modified submission corrects a mistake identified during the assessment session and provides a specific section on constraints and future technical improvement of the FREL. The AT commends Paraguay for correcting the calculation mistake and for providing this additional information.

26. Paraguay provided estimates of the uncertainty associated with the carbon stock in below-ground biomass, above-ground biomass and understory vegetation for each of the forest strata. In addition, information on the accuracy of the two land-use change maps was also provided as part of the modified submission and a detailed description of the methodology used was included as an annex to the submission (annex II). The uncertainty associated with the carbon stock in each of the five forest strata ranges from 6.19 to 15.89 per cent on above-ground biomass of trees, from 5.97 to 14.31 per cent on below-ground biomass of trees and from 12.38 to 28.39 per cent on understory vegetation. The overall accuracy of the land-use change map covering the period 2000–2011 is estimated to be 88.16 per cent and 89.23 per cent for the map covering the period 2011–2015. The AT commends Paraguay for the development and provision of specific information on uncertainty and accuracy and for the ongoing efforts to increase the accuracy of the estimates of future submissions.

Description of relevant policies and plans, as appropriate

27. As the proposed FREL is based entirely on historical data, no assumptions about future changes to domestic policies have been included in the present FREL submission. Information on the causes of the deforestation and possible future trends has been included in the submission as part of the description of national circumstances. The information provided summarizes the factors that have driven deforestation in the past, and describes two possible scenarios that could take place, starting in 2019, depending on whether the

[27] Refer to Annex VI of the modified submission for information on carbon stocks for the following forest types: “Bosque Húmedo del Chaco”, “Sabana Palmar/Bosque de Palmar” and “Transición Bosque Meso Xerofítico y Palmar.”

"ley de deforestation cero"[28] is extended or not. This law, prohibiting forest conversions in the east region, entered into force in 2004 and is effective until 31 December 2018.

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

28. According to decision 12/CP.17, subparagraph (c) of the annex, 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.

29. The carbon pools included in the FREL are above-ground biomass and below-ground biomass of tree vegetation and above-ground biomass of the understory vegetation. Dead wood, litter and soil were not reported. With regard to gases, only CO_2 emissions have been estimated and reported in the FREL submission. Paraguay has clarified that, as part of the stepwise approach, future submissions may include the estimation of other gases and carbon pools provided that accurate information is available at that time.

30. The AT could not find information in the FREL submission proving that omitted carbon pools are unequivocally insignificant. Paraguay acknowledged the inclusion of emissions from omitted carbon pools as an area for future improvement to be covered under the stepwise approach. Paraguay provided, as part of the annexes to the submission (annex v), preliminary results on carbon stock in some of the omitted carbon pools, explaining that these results are not suitable for inclusion in the FREL owing to the high associated uncertainty or because of the lack of data needed for estimating GHG emissions.

31. As regards the pool soil organic carbon in mineral soils, Paraguay has provided preliminary results of carbon content for each of the forest strata, and information on the methodology that was used to derive them. The carbon content estimated for a soil depth of 50 cm range from 32.35 to 64.07 t C/ha, with associated errors being 18.08 per cent and 5.76 per cent. Paraguay explained that these preliminary results cannot be used for the estimation of CO_2 emissions from this pool owing to the lack of information on carbon content of soil for other land-use categories, which is needed to assess the net variation of carbon resulting from deforestation. Furthermore, in response to a question raised by the AT, Paraguay clarified in the modified submission that CO_2 emissions from this pool, when forests are converted to cropland and other lands, as included in its GHG inventory, were estimated assuming that all the carbon in soil is oxidized after the conversion. The AT commends Paraguay for its efforts in the collection and provision of information on this carbon pool, and agrees that the lack of information on carbon content of soil in other land uses prevents a proper estimation of the emissions, as the assumption of a full oxidation of the carbon content of soil would overestimate the emissions from this pool. The AT therefore considers that the omission of this pool is, for the moment, adequately justified by Paraguay; however, noting the magnitude of the preliminary results on soil carbon stock provided by Paraguay, the AT considers the assessment of the significance of emissions from this pool as an area of further improvement that should be addressed when the necessary information becomes available.

32. As regards the carbon pools dead wood and litter, Paraguay has provided preliminary results on the carbon stock for each of the forest strata and information on the methodology that was used to derive them. The carbon content of these pools ranges from 0.16 to 9.94 t C/ha in dead wood and from 0.632 to 3.38 t C/ha in litter. Paraguay clarified in the modified submission that these results are still preliminary and that it cannot be assumed that all the carbon presented in litter is oxidized after the forest conversion because part of this carbon remains in the forest floor. The AT acknowledges the

[28] Ley 2524 de Prohibición en la Región Oriental de Actividades de Transformación y Conversión de Superficies con Cobertura de Bosques.

clarification and considers that the pools litter and dead wood are likely not significant pools relative to other carbon pools, and therefore that their exclusion from the FREL is justified; however, the AT considers that Paraguay should enhance the information provided to justify the omission of these pools in line with decision 12/CP.17.

33. The AT noted that while some official documents provided information on the presence of organic soils in Paraguay, information on this carbon pool was not provided in the original submission. Paraguay explained in the modified submission that soil organic carbon in organic soils was excluded from the proposed FREL owing to the lack of scientific knowledge and data on carbon content from field measurements, and stated during the exchange of information that some studies could be launched using available resources to assess the total areas of these soils within the country. The AT considers that, depending on the magnitude of the areas of organic soils in which deforestation takes place, this pool might be a significant source of emissions as there is a large quantity of carbon stored in these soils; therefore, the assessment of the significance of emissions from this pool is seen as an area for future improvement to be addressed as part of the stepwise approach.

34. The AT noted that the GHG inventory included as part of the submission of the 2015 BUR included estimates of N_2O emissions from soils as a result of the conversion of forest land to cropland. The AT noted that these estimates (8.98 Gg N_2O[29]) justified the omission of this GHG from the FREL, on the basis of the insignificance of these emissions, as they represent, in terms of CO_2 equivalent, about 10 per cent of the CO_2 emissions reported for this pool in the GHG inventory. However, the AT notes that, as stated by Paraguay in its modified submission, the slash and burn method of converting native forests to agricultural land is common practice in Paraguay and, therefore, it considers the treatment of non-CO_2 emissions to be an area for future improvement.

35. Among the eligible activities according to decision 1/CP.16, paragraph 70, Paraguay has chosen "reducing emissions from deforestation" in the calculation of the FREL. Paraguay has included in the modified submission information on the efforts that are ongoing to define forest degradation. The AT commends Paraguay for assessing the option of the future inclusion of this activity and for providing this information. The AT acknowledges that the activity included by Paraguay in the FREL (reducing emissions from deforestation) is the most significant of the five activities identified in paragraph 70 of decision 1/CP.16, in accordance with national capabilities and circumstances. It notes that, owing to a lack of any information on emissions from forest degradation, it is currently not possible to assess whether this activity is significant in terms of emissions.

4. Definition of forest

36. In its submission, Paraguay provided the definition of forest used in the construction of the FREL.[30] This definition is the same as the one that the Party uses in its national GHG inventory included as part of the 2015 BUR.

37. In response to a question by the AT, Paraguay explained the constraints that were encountered regarding the implementation of this definition during the generation of the 2011 forest cover map and land-use change maps that were used to assess deforestation (see para. 22 above), clarifying that in practice only areas with forest cover of 30 per cent or larger (20–40 per cent) could be identified as forests.

[29] This corresponds to 2,676.04 Gg CO_2 eq using a global warming potential value of 298.
[30] As footnote 26 above.

III. Conclusions

38. The information used by Paraguay in constructing its FREL for deforestation is overall transparent and complete and is in overall accordance with the guidelines for the submission of information on FRELs (as contained in the annex to decision 12/CP.17).

39. The AT acknowledges that Paraguay included in the FREL the most significant activity and the most significant pools in terms of emissions from deforestation. The AT considers that, in doing so, Paraguay followed decision 1/CP.16, paragraphs 70 (on activities undertaken) and 71(b), and decision 12/CP.17, paragraph 10 (on implementing a stepwise approach). The AT commends Paraguay for the information provided on the ongoing work to improve the accuracy and coverage of future FRELs with new data (see paras. 7 and 9 above).

40. As a result of the facilitative interactions with the AT during the TA session, Paraguay submitted a modified submission that took into consideration the technical inputs by the AT. Paraguay implemented a correction of a calculation mistake, provided additional methodological information and identified areas for future improvement. The AT notes that the transparency and completeness of information improved significantly in the modified FREL submission and commends Paraguay for the efforts made.

41. Paraguay explained that the FREL is not consistent with the GHG inventory[31] provided in its 2015 BUR because, for the purposes of the FREL, activity data and emission factors have been updated owing to an institutional decision taken at the time of the submission of the FREL. The AT acknowledges this explanation and highlights that consistency in terms of pools and gases should be addressed in future FREL submissions (see para. 20 above).

42. In addition, pursuant to decision 13/CP.19, annex, paragraph 3, the AT identified the following areas for future technical improvement:

(a) The development of an improved system for activity data collection that allows the assessment of deforested areas in line with the adopted forest definition, as well as the spatially explicit identification of palm areas (see paras. 22–23);

(b) The increase of the sample size by the collection of dasometric information on a larger number of sample units and the development of more species-specific allometric equations (see para.24).

43. In assessing the pools and gases included in the FREL pursuant to 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) The collection of information on the dynamics of carbon stocks in the dead wood, litter and mineral soils pools after forest conversion in order to assess the significance, in terms of emissions, of these pools (see paras. 31–33 above);

(b) The collection of information needed to estimate emissions from organic soils subject to deforestation or to justify the omission of these emissions in terms of their insignificance (see paras. 31 and 33 above);

(c) Treatment of emissions of non-CO_2, and, specifically, emissions from the practice of slash and burn (see para. 34 above).

44. The AT acknowledges and welcomes the intention expressed by Paraguay to:

[31] In reference to the scope of the TA, decision 13/CP.19, annex, paragraph 2(a).

(a) Continue working on the forest definition to ensure consistency with other official submissions and in its practical implementation when assessing deforestation (see para. 21 above);

(b) Continuously improve the collection of information on activity data, emission factors and omitted carbon pools, as part of the stepwise approach, for future FREL submissions;

(c) Develop capabilities for the collection of information on emissions from forest degradation, in order to include these emissions in future FREL submissions.

45. The AT notes that in the context of the quality assurance of the estimates, Paraguay could consider the use of geometric volumes estimated at tree level from dasometric information from the national forest inventory to verify and build confidence in the underlying data used for the construction of the FREL.

46. In conclusion, the AT commends Paraguay for showing a strong commitment to the continuous improvement of its FREL estimates, in line with the stepwise approach. A number of areas for future technical improvements by Paraguay have been identified in this report. At the same time, the AT acknowledges that these improvements are subject to national capabilities and policies, and notes the importance of adequate and predictable support.[32] The AT also acknowledges that the assessment process was an opportunity for a rich, open, facilitative and constructive technical exchange of information with Paraguay.

47. The table in the annex summarizes the main characteristics of Paraguay's proposed FREL.

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

Annex

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

Main features of the forest reference emission level		*Remarks*
Proposed FREL (in t CO_2 eq/year)	58 763 376.14	The FREL includes emissions from deforestation (i.e. those associated with loss of forest cover and excluding any subsequent emissions and removals from deforested areas) (para. 7)
Type and duration of FREL	FREL = average historical emissions 2000–2015	Paragraph 7
Adjustment for national circumstances	No	–
National/subnational[a]	National	–
Activities included[b]	Deforestation	Paraguay defines deforestation as the conversion of native forest to non-forest land, excluding the conversion of forest plantations to other land-use categories (gross deforestation) (para. 7) Forest degradation is not included owing to lack of data
Pools included[b]	AB, BB	For the reported pools, it is assumed that the carbon immediately after a deforestation event is zero. SOC, DW, LT are not included owing to a lack of accurate data and a lack of data needed to assess the dynamics of these pools during the deforestation (para. 29)
Gases included	CO_2	Paragraph 34
Forest definition[c]	Included	Native forest is defined for the purposes of the FREL submission as a natural ecosystem with biodiversity, managed or not, regenerated and/or restored naturally or by forest techniques with native species that provide goods, and environmental and social services, and with a minimum area of 1 ha, with a height equal to or higher than 3 m in the west region and 5 m in the east region and which reaches a minimum forest cover in its natural state of 10 per cent in the west region and 30 per cent in the east region. This also includes native palms and bamboo that reaches these thresholds In practice, a minimum threshold of forest cover of 30 per cent (20–40 per cent) was implemented to assess deforested areas (paras. 36–37)
Relationship with latest GHG inventory	Methods used for the FREL are similar to those used for the latest GHG inventory	SOC in mineral soils and N_2O emissions from soil are included in the GHG inventory that is included as part of the BUR, and omitted in the FREL

Main features of the forest reference emission level		*Remarks*
	included in the BUR, but differ in the pools and gases included	(para. 20)
Description of relevant policies and plans[d]	Included	Information included for information purposes (para. 27)
Description of assumptions on future changes in policies[d]	Included	Information included for information purposes (para. 27)
Descriptions of changes to previous FREL	Not applicable	–
Future improvement identified	Yes	Several areas for future technical improvements were identified (paras. 42–43)

Abbreviations: AB = above-ground biomass, BB = below-ground biomass, BUR = biennial update report, DW = dead wood, FREL = forest reference emission level, GHG = greenhouse gas, ha = hectare, LT = litter, SOC = soil organic carbon, t CO_2 eq/year = tonnes of carbon dioxide equivalent per year.

[a] If subnational, comments should include information on the treatment of displacement of emissions.

[b] In the case of omitted pools or activities, comments should include the justification provided by the country.

[c] The forest definition should be summarized, and it should be stated if it differs from the definition used in the GHG inventory or in reporting to other international organizations.

[d] May be relevant to the description of national circumstances, which is required in the case of adjustment.