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Report on the technical assessment of the proposed forest reference emission level of Guinea-Bissau submitted in 2019

Summary

This report covers the technical assessment of the voluntary submission of Guinea-Bissau 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 Guinea-Bissau covers the activity "reducing emissions from deforestation", which is among the activities included in decision 1/CP.16, paragraph 70. For its submission, Guinea-Bissau developed a subnational FREL for the terrestrial component of the National System of Protected Areas with the aim of transitioning to a national FREL in the future. The FREL presented in the original submission, for the reference period 2007–2015, corresponds to 67,805.50 tonnes of carbon dioxide equivalent per year. As a result of the facilitative process during the technical assessment, Guinea-Bissau provided a modified FREL submission, without altering the FREL or the approach used to construct it. The assessment team notes that the data and information used by Guinea-Bissau in constructing its FREL are transparent, 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*
	Abbreviations and acronyms		3
I.	Introduction and summary	1–11	4
	A. Overview	1–6	4
	B. Proposed forest reference emission level	7–11	5
II.	Data, methodologies and procedures used in the construction of the proposed forest reference emission level	12–32	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	12–32	5
III.	Conclusions	33–42	11
Annexes			
I.	Summary of the main features of the proposed forest reference emission level based on information provided by Guinea-Bissau		14
II.	Documents and information used during the technical assessment		15

Abbreviations and acronyms

AD	activity data
ALOS–PALSAR	Advanced Land Observing Satellite–Phased Array type L-band Synthetic Aperture Radar
AT	assessment team
CARBOVEG	project on stored carbon quantification and the carbon sink capacity of forest vegetation under the Ministry of Environment and Sustainable Development of Guinea-Bissau
COP	Conference of the Parties
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
EF	emission factor
FAO	Food and Agriculture Organization of the United Nations
FREL	forest reference emission level
FRL	forest reference level
GHG	greenhouse gas
IBAP	Institute of Biodiversity and Protected Areas of Guinea-Bissau
IPCC	Intergovernmental Panel on Climate Change
LiDAR	Light Detection and Ranging
LULUCF	land use, land-use change and forestry
MODIS	Moderate-resolution Imaging Spectroradiometer
QC	quality control
REDD+	reducing emissions from deforestation; reducing emissions from forest degradation; conservation of forest carbon stocks; sustainable management of forests; and enhancement of forest carbon stocks (decision 1/CP.16, para. 70)
SNAP	National System of Protected Areas
TA	technical assessment
2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*

I. Introduction and summary

A. Overview

1. This report covers the TA of the voluntary submission of Guinea-Bissau on its proposed FREL,[1] submitted on 4 January 2019, in accordance with decisions 12/CP.17 and 13/CP.19. The TA took place (as a centralized activity) from 18 to 22 March 2019 in Bonn and was coordinated by the secretariat.[2] The TA was conducted by two LULUCF experts from the UNFCCC roster of experts[3] (hereinafter referred to as the AT): Eder Larios Guzmán (Mexico) and Koki Okawa (Japan). In addition, Gervais Ludovic Itsoua Madzous, an expert from the Consultative Group of Experts, participated as an observer[4] during the centralized activity in Bonn. The TA was coordinated by Jenny Wong (secretariat).

2. In response to the invitation of the COP and in accordance with the provisions of decision 12/CP.17, paragraphs 7–15 and annex, Guinea-Bissau submitted its proposed FREL on a voluntary basis. The 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. Pursuant to decision 13/CP.19, paragraphs 1–2, and decision 14/CP.19, paragraphs 7–8, 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.

3. In this context, Guinea-Bissau underlined that its FREL submission does not modify, revise or adjust in any way other submissions already made by it (e.g. nationally appropriate mitigation actions, intended nationally determined contribution and national communications).

4. The objective of the TA is to assess the degree to which the information provided by Guinea-Bissau is in accordance with the guidelines for submissions of information on reference levels[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 Guinea-Bissau for the construction and future improvement of its FREL, as appropriate.[7]

5. The TA of the FREL submitted by Guinea-Bissau was undertaken in accordance with the guidelines and procedures for the TA of submissions from Parties on proposed FRELs and/or FRLs.[8] 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 Guinea-Bissau. The facilitative exchange during the TA allowed Guinea-Bissau to provide clarifications and additional information, which were considered by the AT in the preparation of this report.[9] As a result of the facilitative interactions with the AT during the TA, Guinea-Bissau provided a modified version of its submission on 22 May 2019, which took into consideration the technical input of the AT. The modifications improved the clarity and transparency of the submission, without changing the FREL or altering the approach used to construct it. This TA report 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.[10]

[1] The submission of Guinea-Bissau is available at https://redd.unfccc.int/submissions.html?country=gnb.
[2] Per decision 13/CP.19, annex, para. 7.
[3] Per decision 13/CP.19, annex, paras. 7 and 9.
[4] Per decision 13/CP.19, annex, para. 9.
[5] See decision 1/CP.16, para. 71(b).
[6] Decision 12/CP.17, annex.
[7] Decision 13/CP.19, annex, para. 1(a–b).
[8] Decision 13/CP.19, annex.
[9] Per decision 13/CP.19, annex, paras. 1(b) and 13–14.
[10] http://unfccc.int/8414.

B. Proposed forest reference emission level

7. In decision 1/CP.16, paragraph 70, the COP encouraged developing country Parties to contribute to mitigation actions in the forest sector by undertaking a number of activities, as deemed appropriate by each Party 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 Guinea-Bissau, 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 referred to in that paragraph. Pursuant to paragraph 71(b) of the same decision, Guinea-Bissau developed a subnational FREL for the terrestrial component of the SNAP with the aim of transitioning to a national FREL incorporating all forests in the country. The geographical coverage of its subnational FREL encompasses seven protected areas of approximately 750,000 ha, corresponding to about 26 per cent of the national territory. In 2007 (the initial year for estimating historic annual gross deforestation), the forest area within the SNAP was estimated to be 539,225 ha. The SNAP contains the most significant forest, woodland and mangrove ecosystems in the country. For its submission, Guinea-Bissau applied a stepwise approach to developing its FREL in accordance with decision 12/CP.17, paragraph 10. The stepwise approach enables Parties to improve their FRELs and/or FRLs by incorporating better data, improved methodologies and, where appropriate, additional pools.

8. The FREL presented in the submission by Guinea-Bissau for the reference period 2007–2015 corresponds to 67,805.50 t CO_2 eq/year. The FREL is equivalent to the annual average of the CO_2 emissions associated with "gross deforestation", defined as the conversion of forest land to another type of land use or the long-term reduction of the crown cover of trees below the minimum limit of 10 per cent. In addition, "gross deforestation" is limited to accounting only for the area deforested within an area originally classified as "forest" between the monitoring and reporting period and excluding the carbon gains and/or carbon losses from afforestation and reforestation or natural regeneration in the deforested area in the same period. On the basis of this definition, Guinea-Bissau noted in its submission that, owing to limited information on subsequent land use after deforestation and related dynamics, the biomass is assumed to be zero immediately after forest conversion. In other words, post-deforestation CO_2 removals are not considered.

9. The AD for Guinea-Bissau's FREL were obtained from a forest cover change map for 2007–2015 produced on the basis of the difference between two forest cover maps: one for 2007 (with images obtained from the Landsat 5 Thematic Mapper) and the second for 2015 (with images obtained from the Landsat 8 Operational Land Imager).

10. The EFs used for the FREL are the forest carbon stocks per ha (expressed in t CO_2 eq/ha) estimated as the sum of the above-ground and below-ground biomass carbon pools for the total tree biomass. The information used to estimate EFs was obtained from field inventories at the national (CARBOVEG 2007–2009) and subnational level (SNAP 2010–2014). These inventories used the same methodological approach for data collection.

11. The proposed FREL includes the carbon pools above-ground and below-ground biomass. Regarding GHGs, the submission includes CO_2 only.

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 used by the Party in the construction of its forest reference emission level

12. For the construction of its FREL, Guinea-Bissau used the methodologies and guidance provided in the 2006 IPCC Guidelines as a basis for estimating the annual CO_2 emissions from deforestation. The AD are the annual mean changes of forest land to other land uses (in ha/year) as a result of gross deforestation for 2007–2015 in the SNAP. The AD were

estimated from an accuracy assessment of the forest cover change map. The AD were calculated for the following forest cover change categories: closed forest to non-forest, open forest to non-forest, savannah to non-forest, and mangrove to non-forest. To address the limitations of satellite data, a validation and correction of the forest cover change areas was applied to derive bias-corrected area estimates and consequently to derive more accurate AD estimates. This validation assessment was conducted following the guidelines provided by Olofsson et al. (2014). Bias-corrected area estimates were produced for all the forest cover change categories.

13. The EFs (t biomass/ha) were estimated from the total tree biomass (i.e. the sum of above-ground and below-ground biomass). Carbon stock changes were estimated following the stock-difference method from the 2006 IPCC Guidelines (vol. 4, chap. 2, p.2.10). Annual gross emissions were calculated by multiplying AD by the EF for each forest cover change category and on the basis of the assumption that the biomass immediately after forest conversion is zero (i.e. post-deforestation CO_2 removals are not accounted for).

14. In decision 13/CP.19, annex, paragraph 2(b), the AT is requested to assess how historical data have been taken into account in the establishment of the FREL. Guinea-Bissau selected 2007–2015 as the reference period for the proposed FREL as it corresponds to better and more updated data and information than the period used for compiling the national GHG inventory (2006–2012) in the third national communication.[11] The AT requested Guinea-Bissau to clarify why a longer reference period was not used, for example considering several years before 2007. In response, Guinea-Bissau clarified that the data necessary to produce a FREL with a longer reference period are not available. Guinea-Bissau took into account the historical data from national maps that were produced under CARBOVEG (which were also used for the national GHG inventory presented in the third national communication). The initial plan was to include the historical data from these maps and apply 1990 as the starting point of the reference period in order to maintain consistency with the third national communication. However, as the national maps were produced more than a decade ago, Guinea-Bissau determined that they did not have the same high quality as the newer maps developed for the proposed FREL on the basis of imagery obtained through higher-level preprocessing.

15. The AT sought from Guinea-Bissau the reasons for choosing the selected geographical coverage for developing the subnational FREL, which is based on the terrestrial component of the SNAP. During the TA, Guinea-Bissau provided several reasons for its choice of area for developing the subnational FREL as a first step towards developing a national FREL. According to Guinea-Bissau, the SNAP covers 26 per cent of the country and represents the areas identified by the Government as priority areas for conservation. The SNAP comprises the most important and most endangered forests in the country. IBAP, the institute responsible for managing the SNAP, is piloting the Forest Monitoring and Safeguard Information Systems for the SNAP. Guinea-Bissau reiterated that it does not have the necessary data for constructing a national FREL with the same quality as the FREL presented for the SNAP. The AT considers the proposed subnational FREL, as an interim step, to be appropriate, and agreed that the development of a national FREL is an area for future technical improvement.

16. The AT noted that the information on the EFs and AD used for estimating the FREL in the modified submission, together with a new section with a list of reference materials to support the methodological choices made, enhanced the transparency of the submission. During the TA, Guinea-Bissau provided additional information in an Excel spreadsheet, including the data collected between 2007 and 2014 under CARBOVEG to develop EFs, error matrices and the number of pixels for each land-use conversion to obtain AD, which facilitated the reconstruction of the FREL by the AT. The AT considers that the spreadsheet data that were made available to it, if made publicly accessible online, would further improve the transparency of the FREL submission and help build confidence in the estimated emissions.

17. The AT notes that Guinea-Bissau, in its most recent national GHG inventory included in the third national communication, reported emissions from forest and grassland conversion

[11] Available at https://unfccc.int/documents/64689.

of 28,147 kt CO_2 in 2010. Even with the wider geographical scope that the GHG inventory is based on, this value is much larger than the emissions estimated for deforestation in 2007–2015 in the FREL submission, at 68 kt CO_2 eq/year. During the TA, Guinea-Bissau informed the AT that there were a number of reasons behind this difference in estimates, in addition to the subnational nature of the FREL. The GHG inventory was based on national data sets for 1990–2007 combined with relevant statistics (for 2003–2010) from FAO, whereas the FREL was constructed on the basis of data sets for a later period. In addition, the AD used for constructing the FREL were estimated from an accuracy assessment of the forest cover change map (see para. 21 below). The approach used for estimating the AD eliminated errors resulting from conversion from and to plantations and enabled the use of maps based on remotely-sensed data as proxies for forest cover and forest cover change maps and is methodologically different from the approach used for estimating the emissions and removals reported in the GHG inventory. Furthermore, the lower emissions reported in the FREL submission may be the result of the protection measures in place for SNAP areas since 2004. Guinea-Bissau clarified that some methodological details, such as the forest definition and the use of data sets from CARBOVEG, are consistent between the GHG inventory and the FREL submission. While the AT notes that, according to decision 12/CP.17, paragraph 8, proposed FRELs/FRLs should maintain consistency with the anthropogenic forest-related GHG emissions and removals reported in a country's national GHG inventories, it also notes that Guinea-Bissau's latest GHG inventory was based on data from a few years prior to the submission of the proposed FREL and that there are other methodological differences as well. Together with providing the modified submission, Guinea-Bissau clarified the original data used to estimate forest conversion and the use of default IPCC EFs for the third national communication, and informed that the FREL was constructed on the basis of improved data and methodologies. Guinea-Bissau also informed the AT that the methods used for the FREL submission and GHG inventory will be harmonized in the future when the task of mapping plantations is complete. The AT acknowledges the efforts being taken by Guinea-Bissau to maintain consistency in its estimates of forest-related GHG emissions and removals between its future FREL/FRL submissions and GHG inventories in accordance with decision 12/CP.17, paragraph 8. The AT notes that maintaining consistency between future FREL/FRL and GHG inventory submissions is important for ensuring the accuracy and transparency of the estimates in both submissions and notes this as an area for future technical improvement.

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

(a) Methodological information, including description of data sets, approaches and methods

18. During the TA, the AT sought clarification of the procedure for manual and visual correction of the forest cover change map derived from the individual forest cover maps for 2007 and 2015. In response, Guinea-Bissau included details of the correction process in the modified submission and clarified that the process was based on field expert knowledge and on visual inspection of the Landsat imagery and very high resolution imagery available on Google Earth. For this correction process, forest loss, forest gain and stable classes were evaluated by visually comparing the forest cover change map with the imagery available for 2007–2015. The process revealed that many of the originally mapped areas where change occurred were stable classes. Guinea-Bissau is considering testing improved methods for estimating AD, such as direct forest cover change detection to obtain estimates with fewer correction steps and improved accuracy, as an area for future technical improvement. The AT commends Guinea-Bissau for providing detailed information in its modified submission on the methodology and data used for constructing the FREL. The additional information provided during the TA increased transparency and completeness, allowing the AT to reconstruct the FREL.

19. Regarding the accuracy assessment of the forest cover change map, Guinea-Bissau chose the pixel as the spatial assessment unit, which is considered to have the same spatial resolution as the forest cover change map (i.e. 25 by 25 m). The AT sought a number of clarifications regarding the technical reasons for this choice. Guinea-Bissau clarified that its

decision was based on the objective of identifying and quantifying the impact of different drivers of forest loss, including shifting cultivation and mining, which typically occur on smaller scales. Guinea-Bissau provided a set of technical-scientific elements that supported its decision, for example from the studies of Stehman and Wickham (2011), which note that, for an area-based accuracy assessment, a pixel assessment unit is a legitimate and practical option, and Czaplewski (2003), who criticized accuracy assessments using data aggregated into blocks of pixels when the map is not similarly aggregated. The AT acknowledges that Guinea-Bissau included detailed explanations of the technical choice of the spatial assessment unit in the modified FREL submission (section 3.3.1.3) and, by doing so, enhanced the transparency of how the accuracy assessment was carried out. Even though the selected spatial assessment unit to validate the forest cover change map was chosen in order to match the minimum possible area of deforestation, Guinea-Bissau acknowledges that, according to the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*, the minimum mapping unit of forest cover change (0.06 ha) and of forest cover (0.5 ha) should be the same. In this regard, the AT commends Guinea-Bissau for including the following areas for future technical improvement in line with the stepwise approach, in its modified submission: producing AD with the same minimum area as that considered in the forest definition and carrying out a sensitivity analysis of the AD estimates using different sizes of assessment unit (pixel or blocks of pixels). The AT considers that the inclusion of these areas for future improvement reflects Guinea-Bissau's strong commitment to continuously improving the consistency and accuracy of its AD. The AT especially commends Guinea-Bissau for this commitment.

20. Field data gathered to produce EFs were subject to a QC process to select only those plots that met the quality standards required to estimate carbon stocks. This process resulted in the elimination of 338 plots. A total of 364 plots were analysed. The AT noted that this is a large proportion of excluded plots and sought clarification on the impact that this exclusion had on the estimates. Guinea-Bissau clarified that the number of plots analysed is sufficient to estimate terrestrial carbon stocks in the SNAP on the basis of a target of 10 per cent at a 90 per cent confidence interval. Sixty-seven per cent of the total number of plots were measured in the two most representative forest strata, and the uncertainty of the EFs in each stratum is less than 20 per cent. Guinea-Bissau noted that there was no bias in the elimination of plots, and plots were eliminated in all strata. Further details on QC procedures were provided. The QC process included an independent third-party audit of field data, which led to the elimination of many field plots. It also included a re-evaluation of the sample intensity to achieve a target precision for the total and per-strata estimates at the end of each field campaign. The AT commends Guinea-Bissau for providing this information in the modified submission and recognizes the significant effort made to improve QC and to use this information to guide future fieldwork.

21. The AT sought clarification from Guinea-Bissau on its use of the forest definition in two aspects of the classification process (through the construction of a classifier): the classification of different forest types and non-forest classes, and the treatment of cashew plantations in the classification of forest. In response to the first aspect, Guinea-Bissau clarified that the classifier is based on the training areas, which are representative of the different forest types. The first step was to use the training data to identify homogeneous regions with different spectral signatures in Landsat imagery. The training areas were drawn using a region growing algorithm that selects the neighbouring pixels around a central pixel within a certain range of reflectance values. The second step was to verify if those training areas were consistent with the forest definition. For this second step, Guinea-Bissau used Google Earth images, field expertise and forestry knowledge. Regarding the second aspect, Guinea-Bissau confirmed that cashew plantations were not classified as forest because of their tree height. The Party noted that it is difficult to exclude cashew plantations from the land cover maps produced from Landsat data. Cashew plantations were manually eliminated from the maps when their location was known, but they were mostly excluded through the correction of areas exercise, as described in section 3.3.1.2 (p.15) of the modified submission on the post-processing phase. The correction of areas exercise used an extensive data set of 841 sampling units from direct observation and inspection of very high resolution imagery and the methods described by Olofsson et al. (2014). Through this exercise, in addition to cashew plantations being excluded, all other cases where there are known limitations of using

estimates derived from Landsat imagery as a proxy for forest and forest changes were corrected as well. The AT commends Guinea-Bissau for providing this detailed information on the use of its forest definition and acknowledges that this increases the transparency of the submitted FREL.

22. The AT sought further clarification from Guinea-Bissau on the possibility of estimating removals from biomass growth in cashew plantations, as the expansion of cashew plantations was identified as one of the main drivers of deforestation in the country. In response, Guinea-Bissau explained that the FREL includes only gross emissions, and the removals after deforestation are assumed to be zero as there is limited information on subsequent land use after deforestation and its dynamics (see p.10 of the submission). Furthermore, direct conversion of forest to cashew plantation is assumed to be rare, according to expert knowledge and some observations of very high resolution imagery. The AT commends Guinea-Bissau for its plans to undertake a new forest inventory that will include quantifying and mapping areas converted to plantations (from forest and non-forest) as an area for future technical improvement of the FREL. Guinea-Bissau acknowledges that the information derived from the new forest inventory will improve the accuracy of the estimates of emissions from forest converted to other land uses and the accuracy of the estimates of removals by biomass stocks. The AT considers that the treatment of removals from biomass growth in cashew plantations after deforestation may also increase the accuracy of the emission estimates in future submissions.

23. Guinea-Bissau provided a description of the uncertainty analysis on adjusted areas and the combination of uncertainties for each forest cover change category (in section 4.2 of the submission). The uncertainty of estimated forest cover change areas was calculated using the sample count in the error matrix and the proportion of mapped areas in each forest cover change category. The combination of uncertainties followed the propagation of errors approach described in the 2006 IPCC Guidelines. Total uncertainty for the proposed FREL was estimated to be 20.3 per cent. However, the uncertainty associated with the EFs was not included owing to the uncertainty associated with biomass equations. The AT commends Guinea-Bissau for planning to implement robust tier 3 methodologies to assess the uncertainty of the FREL as an area for future technical improvement. This includes considering all sources of error not yet included in the submission, namely measurement errors and allometric model errors. The AT considers that the inclusion of complete information on uncertainty in future FREL submissions would help build confidence in the emission estimates and facilitate identification of areas on which to focus improvement efforts.

(b) Description of relevant policies and plans, as appropriate

24. The proposed FREL is based on historical data and does not take into account the potential impacts of current or future national policies. In response to a request from the AT, information on policies and plans that was included in the original submission was expanded in the modified submission. Guinea-Bissau has been devoting sustained efforts to mainstreaming climate change adaptation, mitigation and resilience in its national strategies, policies and sectoral plans, namely in its Development Strategy Plan 2025.[12] These efforts led to the establishment of the SNAP. In addition, on the basis of this development strategy, Guinea-Bissau established an inter-ministerial working group on REDD+ to drive the initial steps of REDD+ preparation and implementation and produced a multi-stakeholder road map for REDD+.[13] The AT commends Guinea-Bissau for providing information on the various strategies directly related to REDD+, for example the Strategy and National Action Plan for the Biodiversity 2015–2020.[14]

[12] Known as *Terra Ranka* in the country. See https://prais.unccd.int/sites/default/files/2018-09/Plan%20Strategique%20GB%202025%20-%20Rapport%20Final%20-%2014-03-2015.pdf (in French).

[13] Available at https://www.rset.eu/gb-frel (in Portuguese). A policy brief (in English) summarizing the priority action areas is also available.

[14] See https://www.cbd.int/doc/world/gw/gw-nbsap-v2-en.pdf.

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

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

26. The pools included in the Party's FREL are above-ground and below-ground biomass. The deadwood, litter and soil organic carbon pools were not included. Responding to a question from the AT, Guinea-Bissau explained that preliminary information from the national forest inventory (CARBOVEG) to estimate emissions from litter was collected in 2008. During the TA, the result of this data collection was shared with the AT in an Excel spreadsheet. However, an institutional decision to prioritize the above-ground and below-ground biomass pools was taken during CARBOVEG and the preparation of the FREL submission. The available data on emissions from above-ground and below-ground biomass were considered to be more accurate. The AT considers that the exclusion of deadwood, litter and soil organic matter at this stage was adequately justified by Guinea-Bissau, and that a conservative approach was taken. The AT commends Guinea-Bissau for considering the inclusion of omitted carbon pools in future submissions, as part of the stepwise approach, depending on the availability of resources to collect accurate data. The AT notes that the 2006 IPCC Guidelines provide methodologies, including default values, that can be used by Guinea-Bissau for estimating changes in carbon stocks in the omitted pools.

27. The proposed FREL includes only CO_2 emissions from deforestation. The AT considers that the non-inclusion of non-CO_2 gases has been adequately explained in the submission. Guinea-Bissau indicated that, despite slash-and-burn practices, non-CO_2 gases were excluded from the FREL due to the absence of spatially explicit and complete data on burned areas in forests cleared between 2007 and 2015. The AT commends Guinea-Bissau for planning to include emissions associated with forest fires as an area for technical improvement of future FREL submissions. Future improvements include mapping burned areas in forests remaining forests and separating those from fires in areas converted to agriculture (deforestation), and considering the future inclusion of non-CO_2 emissions from the latter. According to Guinea-Bissau, although the current MODIS sensor offers easy-to-use products for mapping burned areas, it is envisaged that more accurate, alternative higher-resolution AD sources will be researched for long-term use. The AT notes that the inclusion of non-CO_2 gases would increase consistency with the GHG inventory included in Guinea-Bissau's third national communication, and considers the treatment of non-CO_2 gases to be an area for future technical improvement.

28. The AT notes that Guinea-Bissau 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. The AT also notes that other activities could also be significant, in particular reducing emissions from forest degradation and enhancement of forest carbon stocks. The AT sought clarification on the reasons for excluding these activities. In response, Guinea-Bissau explained that the two activities, while considered significant, were omitted due to lack of accurate and consistent data. However, measures to reduce emissions from forest degradation (e.g. controlled production of charcoal, promotion of energy-efficient stoves, reduction of illegal logging through enhanced law enforcement) and a number of afforestation, reforestation and managed regrowth initiatives are being coordinated and implemented in the SNAP. Several strategies, plans, inventories and reports highlight the potential of carbon sequestration in the forest sector, including the national strategic plan on biodiversity (see para. 24 above), the third national communication and the intended nationally determined contribution,[15] with the latter listing afforestation and reforestation as contributing to both mitigation and adaptation.

29. Guinea-Bissau indicated that the data collected for developing EFs and AD are suitable for quantifying the emissions associated with gross deforestation but are not suitable for estimating emissions from forest degradation. On the basis of the national context, uncontrolled fuelwood collection and illegal logging are known activities contributing to the increase in forest degradation in the country. Guinea-Bissau recognizes the importance of

[15] Available at https://www4.unfccc.int/sites/submissions/INDC/Submission%20Pages/submissions.aspx.

quantifying the forest areas affected by forest degradation and their emissions and is still discussing possible alternative approaches to addressing these issues. The AT commends Guinea-Bissau for its plans to assess emissions from forest degradation and to include this activity in future FREL submissions as part of the stepwise approach.

30. With respect to enhancement of forest carbon stocks, Guinea-Bissau indicated that IBAP has been implementing forest restoration in degraded forests and abandoned cultivated fields. The enhancement of forest carbon stocks from the conversion of non-forest land to forest land and in forest land remaining forest land is considered a significant activity in the SNAP. However, there is no reliable information on the area change or specific EFs to allow for the inclusion of this activity in the FREL. The AT acknowledges that inclusion of this activity was identified by Guinea-Bissau as an area for future technical improvement as part of the stepwise approach.

31. Guinea-Bissau identified the testing of new and existing methods for estimating emissions and removals from forest degradation and enhancement of forest carbon stocks as an area for technical improvement of future FREL/FRL submissions. Guinea-Bissau stated that possible ways to quantify forest degradation include mapping burned areas in forests remaining forests and fuelwood collection using participatory rural appraisal methods, while, for enhancement of carbon stocks, a combination of forest cover change maps and tabular cadastral records of afforestation and restoration areas from IBAP can be used. For both forest degradation and enhancement of forest carbon stocks, new technologies such as LiDAR (e.g. the Global Ecosystem Dynamics Investigation[16]) or radar (e.g. ALOS–PALSAR[17]) can also be tested for estimating biomass and constructing carbon change maps. The AT commends Guinea-Bissau for its plans and ongoing efforts to monitor these important activities and acknowledges that the inclusion of other activities, when better information become available as part of the stepwise approach, will improve future FREL/FRL submissions.

4. Definition of forest

32. Guinea-Bissau provided in its submission the definition of forest used in the construction of its FREL. Forest land is defined as land with an area of more than 0.5 ha with trees that have reached or with a capacity to reach a height of more than 5 m and a crown cover of greater than or equal to 10 per cent. Predominantly agricultural or urban land is not included in the definition. The definition is the same as the one that the Party uses for its national GHG inventory and its reporting to FAO for the Global Forest Resources Assessment.

III. Conclusions

33. The information used by Guinea-Bissau in constructing its FREL for "reducing emissions from deforestation" is transparent, complete and in overall accordance with the guidelines for submissions of information on reference levels.

34. The FREL presented in the submission, for the reference period 2007–2015, corresponds to 67,805.50 t CO_2 eq/year.

35. The AT acknowledges that Guinea-Bissau included in its FREL the most significant activity, the most important forest area and the most significant pools in terms of emissions from forests. The AT considers that, in doing so, Guinea-Bissau followed decision 1/CP.16, paragraph 70, on activities undertaken; paragraph 71(b), on elaboration of a subnational FREL as an interim measure; and decision 12/CP.17, paragraph 10, on applying the stepwise approach. The AT commends Guinea-Bissau for providing information on its ongoing work to develop FRELs for other activities, as well as for other forest areas, as a step towards constructing a national FREL (see paras. 28–31 above).

36. As a result of the facilitative interactions with the AT during the TA, Guinea-Bissau provided a modified submission that took into consideration the technical input of the AT.

[16] See https://gedi.umd.edu/.
[17] See https://www.eorc.jaxa.jp/ALOS/en/about/palsar.htm.

The AT notes that the transparency and completeness of the data and information provided were significantly improved in the modified FREL submission, without alteration of the approach or values used to construct the FREL, and commends Guinea-Bissau on its efforts. The new information provided in the modified submission increased the reproducibility of the FREL calculations.

37. The AT notes that, for a number of methodological reasons, the FREL does not maintain consistency, in terms of sources of AD and EFs, with the GHG inventory included in Guinea-Bissau's national communication[18] (see para. 17 above).

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

(a) Developing a national FREL covering all forest areas in the country when resources become available for correcting current national maps and taking advantage of the better preprocessed and georeferenced data available (see para. 15 above);

(b) Making publicly available online the data spreadsheets derived from CARBOVEG that were used in developing EFs, AD and error matrices, and shared with the AT during the TA, to enhance the transparency and completeness of future FREL submissions (see para. 16 above);

(c) Maintaining consistency between future FREL/FRL submissions and GHG inventories, particularly for forest-related GHG emissions and removals (see para. 17 above);

(d) Considering the treatment of removals from biomass growth in cashew plantations after deforestation in order to enhance the accuracy of the emission estimates in future FREL submissions (see para. 22 above);

(e) Including complete information on uncertainty analysis in future FREL submissions to enhance confidence in the estimates and facilitate identification of areas for future technical improvement (see para. 23 above).

39. Pursuant to decision 13/CP.19, annex, paragraph 2(f), in assessing the pools and gases included in the FREL, the AT noted that the clarification provided by Guinea-Bissau on the exclusion of deadwood, litter and soil organic matter and non-CO_2 emissions from forest fires is justified as a conservative approach taken to construct the FREL (see paras. 26–27 above). The AT acknowledges the areas for future technical improvement identified by Guinea-Bissau that would allow for the inclusion of these omitted pools and gases in future FREL submissions.

40. The AT acknowledges and welcomes Guinea-Bissau's intention to:

(a) Expand the coverage of the FREL to the entire national territory and possibly expand the reference period for better consistency with its national communications (see para. 15 above);

(b) Expand the number of REDD+ activities included, such as reducing emissions from forest degradation and enhancement of forest carbon stocks, as well as test methods for estimating emissions and removals from these other activities (see paras. 28–31 above);

(c) Undertake a new forest inventory that will allow quantification and mapping of forest and non-forest areas converted to plantations (see para. 22 above);

(d) Test improved methods for estimating AD such as direct forest cover change detection to obtain more accurate estimates that require fewer correction steps (see para. 19 above);

(e) Include a sensitivity analysis of the AD estimates using sampling units of different sizes (pixels or blocks of pixels) as the data sets (see para. 19 above);

(f) Implement robust IPCC tier 3 methodologies to assess the uncertainty of the FREL (see para. 23 above);

[18] In reference to the scope of the TA, as per decision 13/CP.19, annex, para. 2(a).

(g) Include emissions from omitted carbon pools and omitted GHGs from forest fires (see paras. 26–27 above).

41. In conclusion, the AT commends Guinea-Bissau for showing a strong commitment to the continuous improvement of its FREL estimates in line with the stepwise approach. A number of areas for the future technical improvement of Guinea-Bissau'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 providing adequate and predictable support.[19] The AT also acknowledges that the TA was an opportunity for a rich, open, facilitative and constructive technical exchange of information with Guinea-Bissau.

42. The table contained in annex I summarizes the main features of Guinea-Bissau's proposed FREL.

[19] Per decision 13/CP.19, annex, para. 1(b), and decision 12/CP.17, para. 10.

Annex I

Summary of the main features of the proposed forest reference emission level based on information provided by Guinea-Bissau

Main features of the FREL		*Remarks*
Proposed FREL	67 805.50 t CO_2 eq/year	The proposed FREL covers the terrestrial component of the SNAP (see paras. 7–8 of this document)
Type and reference period of FREL	FREL = average of historical emissions in 2007–2015	The FREL was constructed on the basis of the annual average of the CO_2 emissions associated with gross deforestation over the historical period 2007–2015 (see para. 8 of this document)
Application of adjustment for national circumstances	No	—
National/subnational	Subnational	The FREL covers the terrestrial component of the SNAP (see para. 7 of this document)
Activities included	Reducing emissions from deforestation	See paragraphs 7 and 28 of this document
Pools included	Above-ground biomass Below-ground biomass	These two pools were prioritized as the available data were more accurate (see para. 26 of this document)
Gases included	CO_2	Non-CO_2 gases were excluded due to the absence of spatially explicit and complete data on burned areas in forests (see para. 27 of this document)
Forest definition	Included	Land with an area of more than 0.5 ha with minimum tree height of 5 m or with a capacity to reach this height and a crown cover equal to or greater than 10 per cent (same definition as for reporting to FAO) (see para. 32 of this document)
Consistency with latest GHG inventory	Methods used for estimating the FREL are not consistent with the latest GHG inventory (2018)	Guinea-Bissau provided a number of reasons for the difference in estimates between the GHG inventory and the FREL submission (see para. 17 of this document)
Description of relevant policies and plans	Included	See paragraph 24 of this document
Description of assumptions on future changes to domestic policies	Not applicable	—
Description of changes to previous FREL	Not applicable	—
Identification of future technical improvements	Included	Several areas for future technical improvement were identified (see paras. 38 and 40 of this document)

Annex II

Documents and information used during the technical assessment

A. Reference documents

Czaplewski RL. 2003. Accuracy assessment of maps of forest condition: statistical design and methodological considerations. *In:* MA Wulder and SE Franklin (eds.). *Remote Sensing of Forest Environments*. Boston: Springer Press. pp.115–140.

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Olofsson P, Foody G, Herold M, et al. 2014. Good practices for estimating area and assessing accuracy of land change. *Remote Sensing of Environment.* 148: pp.42–57. Available at https://doi.org/10.1016/j.rse.2014.02.015.

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Stehman SV and Wickham JD. 2011. Pixels, blocks of pixels and polygons: choosing a spatial unit for thematic accuracy assessment. *Remote Sensing of Environment.* 115(12): pp.3044–3055. Available at https://doi.org/10.1016/j.rse.2011.06.007.

B. Additional information provided by the Party[1]

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REDD+ Working Group. 2016. *Roadmap de Preparação para o REDD+ na Guiné-Bissau (2016–2020).* Republic of Guinea-Bissau. Available in Portuguese at https://www.rset.eu/gb-frel.

[1] Reproduced as received from the Party.