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Technical report on the technical analysis of the technical annex to the first biennial update report of Gabon submitted in accordance with decision 14/CP.19, paragraph 7, on 29 December 2021

Summary

This technical report covers the technical analysis of the technical annex submitted on a voluntary basis, in the context of results-based payments, by Gabon on 29 December 2021 through its first biennial update report in accordance with decision 14/CP.19. The technical annex provides data and information on the 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, which are the activities included in decision 1/CP.16, paragraph 70, and covers the same national territorial forest area as the assessed forest reference level (FRL) proposed by Gabon in its modified FRL submission of October 2021.

Gabon reported the results of implementing these activities for 2010–2018, which amount to 187,104,289 tonnes of carbon dioxide and were measured against the assessed FRL of –96,468,186 tonnes of carbon dioxide per year, including an adjustment for national circumstances (results of 90,636,103 tonnes of carbon dioxide measured against a FRL of –107,186,873 tonnes of carbon dioxide per year without adjustment).

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

Abbreviations and acronyms

2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*
2019 Refinement to the 2006 IPCC Guidelines	*2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*
AD	activity data
BUR	biennial update report
CO_2	carbon dioxide
EF	emission factor
FRL	forest reference level
GHG	greenhouse gas
IPCC	Intergovernmental Panel on Climate Change
LiDAR	Light Detection and Ranging
LULUCF	land use, land-use change and forestry
MRV	measurement, reporting and verification
NFMS	national forestry monitoring system
NRI	national resources inventory
REDD+	reducing emissions from deforestation; reducing emissions from forest degradation; conservation of forest carbon stocks; sustainable management of forests; and enhancement of forest carbon stocks (decision 1/CP.16, para. 70)
TA	technical analysis
TTE	team of technical experts

I. Introduction, overview and summary

A. Introduction

1. This technical report covers the TA of the technical annex provided by Gabon on 29 December 2021 in accordance with decision 14/CP.19, paragraph 7, included in its first BUR, which was submitted in accordance with decision 2/CP.17, paragraph 41(a), and annex III, paragraph 19. In the technical annex, Gabon provided the data and information used for estimating its anthropogenic forest-related emissions by sources and removals by sinks, forest carbon stocks, and changes in forest carbon stock and forest area resulting from implementing REDD+ activities. The submission of the technical annex is voluntary and in the context of results-based payments in accordance with decision 14/CP.19, paragraph 8. The TA was coordinated by Pierre Brender (secretariat).

2. In this context, Gabon underlined that the submission of the technical annex through its first BUR was made voluntarily in the context of results-based payments in line with the Warsaw Framework for REDD+ and does not modify, revise or adjust in any way the nationally appropriate mitigation actions voluntarily submitted by the Party under the Bali Action Plan or its nationally determined contribution under the Paris Agreement.

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

4. Gabon made its first FRL submission, in accordance with decision 12/CP.17, on 8 February 2021, which was subject to a technical assessment following the guidance provided in decision 13/CP.19 and its annex. Gabon made a modified FRL submission on 15 October 2021. The assessed FRL was included as one of the elements of the technical annex to its first BUR in accordance with the guidelines contained in decision 14/CP.19, annex. The findings from the technical assessment of the FRL are included in a separate report.[2]

B. Process overview

5. The TA of the first BUR of Gabon took place from 4 to 8 April 2022 as a desk analysis and was undertaken by the following TTE drawn from the UNFCCC roster of experts on the basis of the criteria defined in decision 20/CP.19, annex, paragraphs 2–6: Kwame Agyei (Ghana), Florian Claeys (France), Kenel Delusca (Haiti), Danielly Godiva Santana Molleta (Brazil), Rana Humbatova (Azerbaijan), Jean Claude Kabamba Lungenyi (Democratic Republic of the Congo), Carmen Schmid (Austria) and Arda Uludag (Türkiye). Kwame Agyei and Florian Claeys were the LULUCF experts who undertook the TA of the technical annex in accordance with decision 14/CP.19, paragraphs 10–13.

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

7. During the TA and subsequent exchanges, the LULUCF experts and Gabon engaged in technical discussions, and Gabon provided clarifications, including a modified technical annex, in response to questions raised by the LULUCF experts, in order to reach an understanding on the identification of the capacity-building needs of the Party and the areas for future technical improvement.

8. Following the TA of the technical annex, the LULUCF experts prepared and shared the draft technical report with Gabon for its review and comments. The LULUCF experts responded to the Party's comments and incorporated them into and finalized this technical

[1] FCCC/SBI/ICA/2022/TASR.1/GAB.

[2] FCCC/TAR/2021/GAB, published on 31 October 2021.

report in consultation with Gabon. This technical report on the TA of the technical annex was prepared in the context of the modified technical annex submitted by Gabon on 15 June 2022.[3]

C. Summary of results

9. In decision 1/CP.16, paragraph 70, the Conference of the Parties encouraged developing country Parties to contribute to mitigation actions in the forest sector by undertaking a number of activities, as deemed appropriate by each Party in accordance with its respective capabilities and national circumstances. In the context of results-based payments and in line with decision 12/CP.17, Gabon, on a voluntary basis, proposed a national FRL covering the 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 for the purpose of a technical assessment in accordance with decision 13/CP.19 and its annex. The activities are being implemented in Gabon's national territory. The assessed FRL of Gabon, including a 10 per cent adjustment, is –96,468,186 t CO_2/year.

10. The Party's FRL is based on its annual average historical CO_2 emissions associated with the 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 for the historical reference period 2000–2009. In accordance with decision 12/CP.17, paragraph 9, Gabon adjusted its proposed FRL upward by 10 per cent compared with the average annual net removals of –107,186,873 t CO_2/year for 2000–2009, which resulted in the assessed FRL.

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

A. Technical annex

11. For the technical annex to the first BUR submitted by Gabon, see annex I.[4]

B. Technical analysis

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

(a) The methodologies, definitions, comprehensiveness and information provided are consistent between the assessed FRL and the results of implementing REDD+ activities;

(b) The data and information provided in the technical annex are transparent, consistent, complete and accurate;

(c) The data and information provided in the technical annex are consistent with the guidelines referred to in decision 14/CP.19, paragraph 9;

(d) The results are accurate, to the extent possible.

13. The remainder of this chapter presents the results of the TA of the technical annex to the Party's first BUR according to the scope outlined in paragraph 12 above.

[3] Gabon shared a French translation of the modified technical annex, which was published on 22 July 2022, but it was not used by the LULUCF experts for the TA.

[4] As per decision 14/CP.19, para. 14(a).

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

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

15. The LULUCF experts noted that Gabon ensured overall consistency between its assessed FRL and estimated results of implementing the 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 in 2010–2018 by:

(a) Using mostly consistent methodologies and data to generate AD on all forest-cover changes, except logging, from remote sensing products, including wall-to-wall forest-cover maps produced for 1990, 2000, 2010 and 2015 (see paras. 21–22 below for further discussion on the consistency in the AD used to assess land-cover changes). Consistent methodologies were used to generate AD for logging activities on the basis of the volume method, which involved a study (FRM Ingénierie, 2020), part of the supporting documentation submitted with the FRL, to determine a single time-series analysis of timber production volumes;

(b) Using consistent methodologies and data to generate EFs, including country-specific data derived from the NRI, measurements obtained from logging concessions and other national data (collected within the African Tropical Rainforest Observation Network) and IPCC default values if no observations were available, and using in particular the same stratification of forest types, land-use categories and land-tenure classes as those used for the FRL;

(c) Covering the same four carbon pools: above-ground biomass, below-ground biomass, deadwood and litter;

(d) Covering the same gas: CO_2 only;

(e) Covering the same area: entire national territory;

(f) Using the assumption that all carbon from the four pools is lost in the year of the deforestation event;

(g) Using a consistent forest definition, namely tree formation covering at least 30 per cent of the soil over more than 1 ha and more than 20 m wide with trees at least 5 m tall at maturity. Forest does not include land that is predominantly subject to agricultural or urban land use. All forest is considered as managed forest.

16. The LULUCF experts noted that Gabon adjusted its FRL upward by 10 per cent compared with the historical average emissions and removals for 2000–2009, resulting in a proposed FRL of –96,468,186 t CO_2/year for 2000–2009. The adjustment leads to 96,468,186 t CO_2/year additional results, which, when added to the 90,636,103 t CO_2/year results for 2010–2018 without adjustment, leads to 187,104,289 t CO_2/year results with adjustment. Applying the adjustment is intended to take into account national circumstances that affect forest activities, in particular the amount of net emissions avoided through the various policies developed by Gabon to protect the natural environment in the 2000s compared with a 'business as usual' scenario, in which these policies would not have been implemented. In the report on the technical assessment of the proposed FRL of Gabon submitted in 2021 it is noted that "applying the maximum allowable adjustment of 10 per cent to the average annual net CO_2 removals should be sufficiently justified, including the need to apply an adjustment to future net removals, on the basis of national circumstances". During the TA, Gabon justified the 10 per cent adjustment on account of (1) applying the maximum allowed adjustment according to the relevant Green Climate Fund REDD+ guidelines for countries with high forest cover and low deforestation, given that Gabon considers itself to be the most carbon-positive country in the world; (2) expert judgment asserting that 10 per cent is an

accurate and fair adjustment to reflect national circumstances; and (3) the relative difference of 10 per cent between the cumulative net removals in 2000–2018 as reported in the GHG inventory and the cumulative removals projected under the 'business as usual' scenario. The LULUCF experts focused their analysis on the latter explanation and asked Gabon for clarification of the methodology used to make that comparison. The 'business as usual' scenario presented in the technical annex is the same as that presented in the main part of the Party's first BUR. In its modified technical annex, Gabon provided a detailed description of the scenario, including assumptions of gross emissions associated with deforestation, forest degradation and logging, and assumptions of gross removals associated with afforestation, natural regeneration and encroachment and sequestration in standing forests, completed with expert knowledge of Gabon. Although the projections under the scenario are for up to 2050, only 2000–2018 is relevant for the TA. The trend in forest activities under the 'business as usual' scenario corresponds to the continuation of the measured trend in 2015–2018 for deforestation, forest degradation and natural regeneration and encroachment, and in 1990–2018 for the sequestration in standing forests. Gabon indicated that this choice of measurement periods was intended to give the most appropriate representation of the difference between historical performance (including all relevant historical policy decisions) and the 'business as usual' scenario. The LULUCF experts noted that the measurement periods from which the scenario was developed cover, in part or in full, depending on the activity, the results period, so that the adjustment value was not derived independently from the measurements for 2010–2018 used to calculate the results. Furthermore, while the 10 per cent value was determined by comparing projected emissions under the 'business as usual' scenario and the measured emissions in 2000–2018, the adjustment of 10 per cent was applied directly to the average estimated emissions and removals for 2000–2009 in calculating the adjusted FRL. In its modified technical annex, Gabon recognized that there are ways to establish the adjustment other than comparing net removals between the projected 'business as usual' scenario and the reported measured values for 2000–2018. Gabon further indicated that the approach used was a relatively conservative one, as the 10 per cent value resulting from the comparison between historical performance and the 'business as usual' scenario in 2000–2018 is an intermediate value between the 19 per cent value if the comparison had been made only for the results period (2010–2018) and the 1.8 per cent value if the comparison had been made only for the reference period (2000–2009). The LULUCF experts also consider that, owing to the variation in the estimates of net removals reported in the inventory, as well as to any changes to the 'business as usual' scenario, the value of the adjustment will also have to change over time and Gabon will need to reconsider the accuracy of the adjustment methodology and value for future FRL submissions. Therefore, the LULUCF experts note using an adjustment that is determined independently of the results (neither applying to the FRL a constant proportion of the net removals over the reference period determined by comparing observations including the results period with a 'business as usual' scenario nor using such a scenario based at least in part directly on the results) as an area for future technical improvement.

17. In view of the above, the LULUCF experts concluded that the results presented of implementing the 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 are mostly consistent with the assessed FRL. The LULUCF experts commend Gabon for ensuring consistency of data and methodologies between the FRL submission for 2000–2009 and the technical annex with the results of implementing those activities for 2010–2018.

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

18. The LULUCF experts noted that all data, assumptions, methodological constraints and definitions used, including weblinks and cross references to relevant information in both the FRL submission and external sources, were transparently provided by the Party in the technical annex. The LULUCF experts commend Gabon for its efforts to enhance transparency and increase the accuracy of its estimates.

19. As part of the TA process, Gabon provided additional information, in particular further clarifications of assumptions made in estimating the results, on the national

circumstances intended to be reflected and the methodology used for determining the adjustment, and on data collection envisaged for the future. The LULUCF experts commend Gabon for its efforts to increase the transparency and ensure the completeness[5] of the data and information provided, thus allowing for reconstruction of the results.

20. The LULUCF experts noted that Gabon used the same methods and processes to generate AD for estimating the results for 2010–2018, presented in the technical annex, as for constructing the FRL for 2000–2009. Gabon used AD derived from remote sensing to determine forest-cover change; AD derived from timber production volume estimates for logging activities; and AD for biomass gains.

21. In order to estimate the AD from remote sensing for constructing the FRL and estimating the results, Gabon used both Landsat images (2000–2015) and Sentinel images (2015–2018) to estimate forest-cover changes. During the TA, the LULUCF experts sought clarifications from Gabon on the approach adopted to addressing the inconsistencies that could be associated with the use of data sets with different temporal and spatial resolution for the analysis. In its modified technical annex, Gabon indicated that a double assessment was conducted qualitatively between the Sentinel and Landsat images through augmented visual interpretation using Collect Earth and Google Earth Engine imagery to ensure consistency between the data sets. Gabon cited a study by Fichet et al. (2014), which indicated that analysis of forest cover in Gabon undertaken with Landsat imagery did not provide any statistically different results than that using higher-resolution data of at least a similar resolution to that of Sentinel-2 imagery. The LULUCF experts commend Gabon for providing this additional information, which enhanced the transparency of the technical annex, but note that conducting a quantitative analysis of the results of the double assessment of the AD derived from Sentinel and Landsat images as an area for future technical improvement.

22. In its modified FRL submission, Gabon explained that the estimated changes in forest cover for 2015–2018 may not be conclusive as only three years were included in the analysis instead of 5–10 years as for distinguishing between temporary and permanent forest-cover change for both the reference period (2000–2009) and the first part of the results period (2010–2015). During the TA, Gabon explained that it is reanalysing the 2015–2018 data on the basis of the 2021 data. However, it does not envisage that the analysis will have a significant impact on the estimated REDD+ results as any change will affect only the relative allocation of emissions due to permanent versus temporary forest-cover loss, which are measured using the same EFs. The LULUCF experts note that analysing a period of 5–10 years in distinguishing between temporary and permanent forest-cover change for the second part of the results period would enhance the consistency of the methodologies adopted for estimating the FRL and the results. The LULUCF experts therefore commend Gabon for its efforts to reanalyse the 2015–2018 data on the basis of the 2021 data, noting this as an area for future technical improvement.

23. In its modified technical annex, Gabon indicated that data on timber production volume were compiled from all major known sources and validated at the national level. Gabon also compared these estimates with data on export volume, which showed marginal differences between the estimated national timber production volume and the export volume. From the supplementary data provided by Gabon through a link included in the technical annex, the LULUCF experts noted that the national timber production volume was estimated using data from 12 sources, including major international sources such as the Food and Agriculture Organization of the United Nations, the International Tropical Timber Organization and the World Bank. The LULUCF experts also noted that, for three years of the results period, the export volume is higher than the compiled national timber production volume. The LULUCF experts further noted that the estimated national timber production volume encompasses both export and domestic consumption of timber, including illegally logged timber, and it should therefore be expected that the estimated national timber production volume is significantly higher than the exported timber volume for all years of the results period. During the TA, Gabon explained that a detailed study (FRM Ingénierie, 2020), part of the supporting documentation submitted with the FRL, was undertaken to

[5] "Complete" here means including the information necessary for reconstructing the results.

estimate timber production volume, which involved compiling data from known sources, verifying the compiled data using two external sources of export data, and data cleaning through consultative discussions and workshops involving national and international experts. The LULUCF experts commend Gabon for the detailed steps taken to determine the national timber production volume. The LULUCF experts consider undertaking further analysis to understand the reasons for the similarity between the estimated national timber production volume (which includes both timber export and domestic consumption) and the export volume (which excludes domestic consumption) used for the verification to address any potential data bias as an area for future technical improvement.

24. The LULUCF experts noted that Gabon acknowledged in both its modified FRL submission and its technical annex an allocation error of 200,000 ha land under logging concessions to unallocated land (under the category other land tenure) for 2015–2018. During the TA, Gabon indicated that the error was due mainly to a discrepancy concerning the legal status of forest logging permits and was not discovered until after the land-use change analysis for the FRL had been completed. The area of deforestation detected between 2016–2018 in those areas is estimated at about 1.6 ha. It should therefore have been included under logging concessions and excluded from the calculation of deforestation under other land tenure (as the volume method is used to estimate biomass losses for logging concessions). On the basis of preliminary calculations, Gabon estimated that correcting the allocation error would not have a significant impact on the REDD+ results as it would increase them by a maximum of 402 t CO_2/year for 2016–2018 (i.e. a maximum of 0.02–0.03 per cent difference per year for 2016–2018). In the modified technical annex, Gabon indicated that the error will be corrected for its next FRL submission as part of the improvement plan. The LULUCF experts commend Gabon for its efforts to enhance the accuracy of its estimates, noting this as an area for future technical improvement.

25. In the technical annex, Gabon indicated that it combined community forests with logging concessions to constitute the land tenure class logging concessions. During the TA, the LULUCF experts sought clarification from Gabon on whether the logging data include timber production from community forests in addition to the logging concessions. The LULUCF experts noted that order 1,028 of 1 December 2008 provides the legal basis for the establishment of community forests, which suggests that they were largely established during the 2010–2018 results period. Consequently, the volume method used for deriving AD on logging activities may have resulted in underestimation of timber harvests if logging in the community forests were not included. In its modified technical annex, Gabon clarified that all logging emissions were estimated using the volume-based approach from timber production data covering the entire country and therefore included data for all land tenure classes. The LULUCF experts commend Gabon for the additional clarification provided, which enhanced the transparency of the technical annex.

26. The EFs for all forest types except logged forests were derived primarily from the NRI, supplemented with national data from other sources, as well as IPCC default values where national data were unavailable. The EFs for logged forests were based on measurements obtained from logging concessions. Gabon included post-disturbance carbon stocks for above- and below-ground biomass for conversion to cropland and grassland using data from national literature and IPCC default values where national data were unavailable. Post-disturbance carbon stocks for other land categories were assumed to be zero. Removal factors for all forest types were derived from national studies and, where national data were unavailable, regional data for Central Africa and IPCC default values were used.

27. The LULUCF experts noted that forest degradation constitutes a significant source of removals in Gabon. During the TA, the Party indicated that, on the basis of research studies undertaken in the country and comparative studies conducted by other research agencies in Central Africa, it was established that forests harvested at low intensity have higher carbon removals than intact forests, leading to large amounts of removals from degraded forest. Gabon further indicated that, while this observation is valid for above-ground biomass, it is not possible to confirm if it is also valid for other carbon pools such as deadwood, litter and below-ground biomass, and across different forest types and different management and disturbance histories, owing to lack of data. The LULUCF experts commend Gabon for planning to collect data and information on the other carbon pools and other forest contexts,

including by establishing permanent forest plots, as part of its NRI, noting this as an area for future technical improvement.

28. During the TA, the LULUCF experts requested clarification from Gabon on whether the EFs for logging, specifically logging damage factor and logging infrastructure factor, are applicable to illegal logging. The LULUCF experts noted that, in the case of illegal logging, extensive logging infrastructure may not be constructed and consequently the logging infrastructure factor for legal logging may not be applicable to illegal logging. Additionally, as explained in the modified FRL submission, illegal logging includes harvesting of smaller-diameter trees. The LULUCF experts therefore also noted that for illegal logging lower extracted log emissions and logging damage factor may apply than for legal logging. In its modified technical annex, Gabon indicated that it used a national average logging EF based on an assessment undertaken of 12 concessions. Gabon did not assess illegal logging separately or stratify logging emissions by concession type as a result of limited data. The LULUCF experts therefore note collecting data on logging EFs associated with illegal logging as an area for future technical improvement in accordance with the stepwise approach.

29. During the TA, the LULUCF experts requested the Party to explain the treatment of emissions associated with fuelwood extraction and charcoal production. In its modified technical annex, Gabon indicated that emissions from charcoal production were not estimated, whereas urban and rural fuelwood product is expected to be a minor source of emissions. The LULUCF experts noted that Gabon launched a programme for charcoal production in 2013 and that, according to the information contained in the Party's first BUR, charcoal production is expected to increase in the coming years. The LULUCF experts commend Gabon for planning to collect data on fuelwood and charcoal production, noting collecting additional data on fuelwood and charcoal production as an area for future technical improvement in accordance with the stepwise approach.

30. According to decision 12/CP.17, paragraph 8, the FRL shall be established taking into account decision 4/CP.15, paragraph 7, and maintaining consistency with the anthropogenic forest-related GHG emissions by sources and removals by sinks reported in the Party's GHG inventory. The team assessing Gabon's FRL noted that the Party maintained consistency in terms of sources of AD and EFs with those used for the GHG inventory included in the second national communication of Gabon (published in 2011),[6] with the notable exception of emissions and removals associated with soils and fuelwood, which are included in the GHG inventory but excluded from the FRL owing to high uncertainty. The LULUCF experts noted that Gabon also maintained overall consistency in terms of sources of AD and EFs with those used for the GHG inventory included in its first BUR[7] for the estimated results of implementing the 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 for 2010–2018.

31. Gabon is developing an open-access geoportal for publishing all relevant spatially explicit and non-spatial information. The National Land Use Plan is accessible through an interactive platform, while data from the NRI have been published in peer-reviewed scientific articles. The LULUCF experts commend Gabon for providing transparent information and continuing to improve the accuracy of its estimates.

32. The LULUCF experts conclude that Gabon provided the information necessary for reconstructing the results of implementing the 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. The data and information provided in the technical annex are considered to be transparent, mostly consistent, complete and mostly accurate to the extent possible.

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

33. Gabon provided data and information on all the required elements in accordance with the guidelines contained in decision 14/CP.19, annex, namely summary information from the

[6] Available at https://unfccc.int/documents/106873.
[7] Available at https://unfccc.int/documents/414937.

final report containing the assessed FRL; a demonstration that the methodologies used to produce the results are consistent with those used to establish the assessed FRL (as outlined in chap. II.B.1 above); a description of the NFMS and institutional roles and responsibilities in MRV of the results; the information necessary for reconstructing the results (as outlined in chap. II.B.2 above); and a description of how the elements contained in decision 4/CP.15, paragraph 1(c–d), have been taken into account.

34. Gabon provided a summary table with the results of implementing the 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 for 2010–2018, which are consistent with the assessed FRL, thus allowing for reconstruction of the results. The results achieved in terms of emission reductions and enhanced removals are listed in table 2 of the modified technical annex and amount to 187,104,289 t CO_2 for the nine years covered (90,636,103 t CO_2 results without adjustment and 96,468,186 t CO_2 additional results from the adjustment).

35. During the consultation process, Gabon provided additional information regarding the digital workbook used for constructing the FRL and estimating the results. The LULUCF experts commend Gabon for sharing this information.

36. The LULUCF experts noted that Gabon provided a transparent summary of the roles and responsibilities of the agencies and institutions involved in MRV of the results in the technical annex, together with weblinks for accessing further information. The roles and responsibilities of the agencies and institutions involved in MRV activities are transparently reported. The National Observation System of Natural Resources and Forests is in charge of monitoring, evaluating and adapting Gabon's low-emission development activities in the agriculture, forestry and other land use sector, including sustainable forestry, management of protected areas and buffer zones, agricultural expansion and land-use planning. It uses satellite image analysis, field inventories and modelling in order to evaluate, monitor and report on the National Land Use Plan. Gabon's agency for national parks and its space agency are responsible for implementing the National Observation System and are closely tied to the National Land Use Plan.

37. The LULUCF experts noted that Gabon provided in its technical annex a description of the NFMS, which, under the National Observation System, covers the whole country. For estimating emissions and removals, a combination of field data and remote sensing data are used. The collection and analysis of field data by the national parks' agency through the NRI is presented in Poulsen et al. (2020). The NRI is based on a semi-systematic sample of forest land based on a division of the country into 135 cells of 50 km × 50 km with inventory sites randomly located within each cell. Each inventory site consists of one 1 ha plot and four 0.16 ha (40 m × 40 m) satellite plots spaced 250 m apart, with two satellite plots located to the east and west of the permanent plot. In 104 cells, between 2012 and 2014, each tree ≥10 cm diameter at breast height was mapped and identified, and its diameter at breast height measured. Tree heights of 55 randomly selected trees and the 5 largest trees were measured. Above-ground carbon stocks were estimated on the basis of the tree measurements using a pantropical model (Chave et al., 2014). The collection and analysis of the remote sensing data by the space agency, supported by a spatial reference information systems company, is presented in Hugé (2020). The years of observation are 2000, 2005, 2010, 2015 and 2018. The estimates are based on the analysis of 665 primary sampling units of 400 ha distributed throughout the country. After detecting changes in land use (forest and non-forest), the primary sampling units are cross-referenced with georeferenced data on forest concession areas, village locations, protected areas, conservation areas, agricultural areas and community forests for 2000, 2005, 2010, 2015 and 2019. The national parks agency is gathering information on reduced impact logging to support sustainable forest management practices with support from The Nature Conservancy, a non-governmental organization in Gabon. The Ministry of Water and Forests is responsible for the reporting and data management systems for timber production.

38. According to decision 11/CP.19, paragraph 4(b), the NFMS should enable the assessment of different types of forest in the country, including natural forest. Gabon's forests are subdivided at the national level into dense forest, secondary forest, flooded forest and mangrove forest, and further subcategorized as old growth forest, old secondary forest (20–

100 years old), young secondary forest (less than 20 years old), older logged forest (more than 25 years old), logged forest (subdivided into logged forest between 1 and 10 years old, and logged forest between 11 and 25 years old), mangrove forest, colonizing forest and degraded forest. Dense forest comprises old growth forest, old secondary forest, older logged forest and logged forest between 11 and 25 years old; and secondary forest includes young secondary forest, logged forest between 1 and 10 years old, colonizing forest and degraded forest. There are no subcategories of flooded forest or mangrove forest. Gabon's modified FRL submission provides the definitions of each subcategory, which enable better alignment of the forest types with the most appropriate country-specific EFs.

39. Gabon provided a description of how IPCC guidance and guidelines were taken into account in accordance with decision 4/CP.15, paragraph 1(c). For estimating emission reductions and removals, Gabon used methodology provided in the 2006 IPCC Guidelines for estimating carbon stock changes. The 2019 Refinement to the 2006 IPCC Guidelines was consulted as a guiding framework for the simple propagation of error uncertainty and land representation, as well as for default values for perennial crops. Accordingly, the emissions and removals associated with the 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 were estimated for 2010–2018 by combining AD (i.e. areas of annual deforestation) with the appropriate EFs (i.e. emissions associated with the corresponding forest type).

40. In constructing its FRL and estimating the results, Gabon covered the most significant pools. Overall, the exclusion of the soil organic carbon pool and non-CO_2 gases was adequately justified. The LULUCF experts commend Gabon for its intention to obtain better information on soil organic carbon and non-CO_2 gases with the aim of including them in future FRLs and estimates of results, noting this as an area for future technical improvement as part of the stepwise approach.

4. Accuracy of the results proposed in the technical annex

41. The LULUCF experts noted that Gabon estimated the results of implementing the 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 at the national level using a transparent and mostly consistent approach. They commend Gabon for its significant long-term efforts to build up a robust NFMS that is capable of providing transparent estimates of emissions and removals for those activities.

42. Both the established FRL and the results obtained for 2010–2018 from implementing the REDD+ activities are based on the assumptions that the overall area for all activities stays constant and the definitions of the activities are also consistent between the FRL reference period and the results period.

43. The LULUCF experts noted that, given the limited total area of degraded forest over the historical reference and result periods (48,445 ha), removals associated with degradation derive mainly from standing forests that were not degraded during the FRL reference and result periods. During the TA, Gabon clarified that removals associated with standing forests in the rural area land tenure and other land tenure categories were placed under forest degradation. Gabon indicated that since AD were available for deforestation and forest degradation, separating losses and gains between deforestation and forest degradation activities has the advantage of providing information on the magnitude of each activity separately and a better understanding of their relative importance. The LULUCF experts note that providing further explanation of the specific process and rationale for designating removals from forest land remaining forest land under forest degradation would increase the transparency of the technical annex, noting this as an area for future technical improvement.

44. The LULUCF experts noted that net removals during the results period show a decreasing trend. During the TA and in its modified technical annex, Gabon explained the decreasing trend as resulting from the implementation of policy decisions that led to a substantial decrease in timber harvest volume and surface area being logged between 2007 and 2012. As a result, the proportion of the logged area considered recently logged gradually declined, resulting in reduced removals across logged forests. While noting that more recent

increased harvest and installation of new wood processing capacity are likely to lead to future variation in emissions from logging and removals from logged forests, the LULUCF experts commend Gabon for its efforts to enhance the transparency of the results by explaining the dynamics of removals from logged forests.

45. As mentioned in paragraph 39 above, Gabon provided some information related to uncertainties. Gabon applied the error propagation methods from the 2006 IPCC Guidelines (vol. 1, equations 3.1–3.2) and the 2019 Refinement to the 2006 IPCC Guidelines (vol. 1, equations 3.1–3.2) to calculate the uncertainty associated with the AD, EFs and removal factors. The accuracy and uncertainty of the wall-to-wall forest-cover maps produced for 1990, 2000, 2010 and 2015 were assessed following the semi-random sampling method in Sannier et al. (2014), based on 95 per cent confidence intervals. Consistently with the approach used for the FRL, the reported uncertainty is based on one standard error rather than on the commonly applied two standard errors. Under this approach, the overall uncertainty for net removals reported by Gabon in tables W10.3 and W10.4 of the digital workbook used to construct the FRL and estimate the results is 4.4 per cent for 2000–2009 and 3.9 per cent for 2010–2018 (7.4 per cent for 2000–2009 and 6.76 per cent for 2010–2018 were reported in the FRL and in section 4.5 of the modified technical annex on results but Gabon explained to the LULUCF experts that those estimates were not correct). The LULUCF experts conclude that the results are mostly accurate. During the technical assessment of Gabon's FRL, reducing the uncertainty of the AD for REDD+ activities was identified as an area for future technical improvement.

C. Areas identified for future technical improvement

46. The LULUCF experts concluded that the following areas for future technical improvement identified in the report on the technical assessment of Gabon's FRL also apply to the provision of information on the results of implementing the 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:

(a) Improving and applying the country-specific tree volume model;

(b) Developing carbon conversion factors to convert biomass in grassland to carbon stocks;

(c) Obtaining EFs including the carbon content of non-woody biomass;

(d) Ensuring the representativeness of data through the sampling of secondary forest;

(e) Reducing the uncertainty of the AD for REDD+ activities;

(f) Replacing IPCC default values and other generic values derived from the literature with country-specific measurements such as root-to-shoot ratios and biomass stocks in cropland and grassland;

(g) Developing methods to account for emissions and removals from forest plantations;

(h) Improving the methodology used to map the forest area to ensure consistent mapping of forests using satellite imagery based on the criteria used for the forest definition;

(i) Sampling secondary forest to ensure the representativeness of data on removal rates;

(j) Treatment of the deadwood and litter pools using a higher-tier method to improve accuracy;

(k) Treatment of the soil organic carbon pool in constructing the FRL;

(l) Treatment of non-CO_2 emissions from forest fires and nitrous oxide emissions from mineralization of nitrogen in soil organic matter following land-use change on mineral soils in constructing the FRL.

47. Furthermore, the LULUCF experts noted that Gabon could consider:

(a) Applying an adjustment for national circumstances that is determined independently of the results (see para. 16 above);

(b) Conducting a quantitative analysis of the results of the double assessment of the AD derived from Sentinel and Landsat images (see para. 21 above);

(c) Estimating temporary and permanent forest-cover changes over 5–10 years (see para. 22 above);

(d) Further analysing the timber production volume and export data (see para. 23 above);

(e) Correcting the 200,000 ha land allocation error (see para. 24 above);

(f) Collecting data for carbon pools other than above-ground biomass and other forest contexts to refine the estimates of removals from degraded forests (see para. 27 above);

(g) Deriving EFs for illegal logging (see para. 28 above);

(h) Collecting additional data on fuelwood and charcoal production (see para. 29 above);

(i) Including soil organic carbon and non-CO_2 gases in the FRL and the results (see para. 40 above);

(j) Further explaining the consideration of removals under forest degradation (see para. 43 above).

D. Comments and responses of the Party

48. During the consultation process, Gabon noted a number of areas of capacity-building needs. Addressing those needs could enable Gabon to improve its data and methodologies, and include additional activities and gases in future FRL submissions. After exchanges with the LULUCF experts, Gabon identified the following capacity-building needs:

(a) Monitoring emissions from logged forests and illegal logging in accordance with national circumstances;

(b) Estimating forest biomass using LiDAR data;

(c) Processing of L-band radar data for forest disturbance characterization and estimation;

(d) Estimating forest biomass using radar data (Sentinel-1 and other free data);

(e) Developing allometric equations for the most populous deforested species;

(f) Developing carbon stock accounting by remote sensing (terrestrial laser scanning for estimation of biomass).

III. Conclusions

49. The LULUCF experts conclude that Gabon reported the results of implementing the five REDD+ 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. Forest is defined as tree formation covering at least 30 per cent of the soil over more than 1 ha and more than 20 m wide with trees at least 5 m tall at maturity, with the land not subject to any agricultural activity. The technical annex and the FRL cover the entire area of Gabon. The results include estimates of CO_2 emissions and removals from the above-ground biomass, below-ground biomass, deadwood and litter carbon pools for 2010–2018. The results of the activities were estimated and reported using methodologies, definitions, assumptions and information that are consistent with those used for constructing the assessed FRL, including the application of an upward adjustment for national circumstances.

50. The LULUCF experts consider the data and information provided in the technical annex to be transparent, mostly consistent (see in particular para. 47(b–c) above), complete and mostly accurate (see in particular para. 47(a) and (d–e) above).

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

52. The results are mostly accurate, based on the assumptions used. The LULUCF experts note that Gabon applied an adjustment for national circumstances (see para. 16 above).

53. In conclusion, the LULUCF experts commend Gabon for showing strong commitment to continuously improving the data and information used for calculating the results, in line with the stepwise approach, which are consistent with those used for constructing its assessed FRL. Some areas for future technical improvement and capacity-building needs identified by Gabon have been identified in this report. At the same time, the LULUCF experts acknowledge that such improvements are subject to national capabilities and circumstances, and note the importance of adequate and predictable support.[8] The LULUCF experts also acknowledge that the TA process was an opportunity for a facilitative and constructive technical exchange of views and information with Gabon.[9]

[8] As per decision 2/CP.17, para. 57.
[9] As per decision 14/CP.19, paras. 12–13.

Annex I

Technical annex to the biennial update report

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

Annex II

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

Key elements		*Remarks*
Results reported	187 104 289 t CO_2	Includes an adjustment for national circumstances (see para. 16 of this document); the results would be 90 636 103 t CO_2 without adjustment
Results period	2010–2018	
Assessed FRL	–96 468 186 t CO_2/year	According to the modified FRL submission of October 2021; includes an adjustment for national circumstances (see para. 16 of this document), but would be –107 186 873 t CO_2/year without adjustment
		The technical assessment report (FCCC/TAR/2021/GAB) was published on 31 October 2021
Reference period	2000–2009	See paragraph 10 of this document
National/subnational	National	See paragraph 9 of this document
Activities included	Reducing emissions from deforestation Reducing emissions from forest degradation Conservation of forest carbon stocks Sustainable management of forests Enhancement of forest carbon stocks	See paragraph 9 of this document
Pools included	Above-ground biomass Below-ground biomass Deadwood Litter	See paragraph 40 of this document
Gas included	CO_2	See paragraph 40 of this document
Consistency with assessed FRL	Methods, definitions and information used for the assessed FRL are consistent with those used for the results	See paragraphs 15 and 21–22 of this document
Description of NFMS and institutional roles	Included	See paragraphs 36–37 of this document
Identification of future technical improvements	Included	Several areas for future technical improvement have been identified (see paras. 46–47 of this document)

Annex III

Reference documents

A. Reports of the Intergovernmental Panel on Climate Change

IPCC. 2006. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. S Eggleston, L Buendia, K Miwa, et al. (eds.). Hayama, Japan: Institute for Global Environmental Strategies. Available at http://www.ipcc-nggip.iges.or.jp/public/2006gl.

IPCC. 2019. *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.* E Calvo Buendia, K Tanabe, A Kranjc, et al. (eds.). Geneva: IPCC. Available at https://www.ipcc.ch/report/2019-refinement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/.

B. UNFCCC documents

First modified FRL submission of Gabon. Available at https://redd.unfccc.int/submissions.html?country=GA.

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

"Guidelines for submissions of information on reference levels". Decision 12/CP.17, annex. Available at https://unfccc.int/sites/default/files/resource/docs/2011/cop17/eng/09a02.pdf#page=19.

Report on the technical assessment of the proposed FRL of Gabon submitted in 2021. FCCC/TAR/2021/GAB. Available at https://unfccc.int/documents/307970.

C. Other documents

The following references may not conform to UNFCCC editorial style as some have been reproduced as received or as cited in the submission:

Chave J, Réjou-Méchain M, Búrquez A, et al. 2014. Improved allometric models to estimate the aboveground biomass of tropical trees. Global Change Biology. 20(10): pp.3177–3190.

Fichet L-V, Sannier C, Makaga EMK, et al. 2014. Assessing the Accuracy of Forest Cover Map for 1990, 2000 and 2010 at National Scale in Gabon. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing.* 7(4): pp.1346–1356.

FRM Ingénierie, 2020. Analyse des Différentes Sources de Données de Production de Grumes au Gabon. *FRM Ingénierie/Conseil National Climat Gabonais.*

Hugé, J, 2020. Estimation des données d'activités du secteur forestier au Gabon entre 1990 et 2018. *Rapport d'étude préparée par la société SIRS.*

Poulsen JR, Medjibe VP, White LJT, et al. 2020. Old growth Afrotropical forests critical for maintaining forest carbon. *Global Ecology and Biogeography.* 29(10): pp.1785–1798.

Sannier C, McRoberts RE, Fichet L-V, et al. 2014. Using the regression estimator with Landsat data to estimate proportion forest cover and net proportion deforestation in Gabon. *Remote Sensing of Environment.* 151: pp.138–148.