



Report on the technical assessment of the proposed forest reference level of Gabon submitted in 2021

Summary

This report covers the technical assessment of the voluntary submission of Gabon on its proposed forest reference level (FRL) in accordance with decision 13/CP.19 and in the context of results-based payments. The FRL proposed by Gabon covers 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 five activities included in decision 1/CP.16, paragraph 70.

For its submission, Gabon developed a national FRL. The FRL presented in the original submission, for the historical period 2000–2009, corresponds to –97,055,549 tonnes of carbon dioxide per year, including a 10 per cent adjustment. As a result of the facilitative process during the technical assessment, the FRL was modified to –96,468,186 tonnes of carbon dioxide per year, including a 10 per cent adjustment.

The assessment team notes that the data and information used by Gabon in constructing its FRL are transparent, complete and in overall accordance with the guidelines contained in the annex to decision 12/CP.17. This report contains the assessed FRL 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.



Abbreviations and acronyms

2006 IPCC Guidelines	<i>2006 IPCC Guidelines for National Greenhouse Gas Inventories</i>
2019 Refinement to the 2006 IPCC Guidelines	<i>2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories</i>
AD	activity data
AfriTRON	African Tropical Rainforest Observation Network
AT	assessment team
CO ₂	carbon dioxide
COP	Conference of the Parties
EF	emission factor
FAO	Food and Agriculture Organization of the United Nations
FREL	forest reference emission level
FRL	forest reference level
GHG	greenhouse gas
IPCC	Intergovernmental Panel on Climate Change
LiDAR	Light Detection and Ranging
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)
RF	removal factor
RSPO	Roundtable on Sustainable Palm Oil
SIRS	Spatial Reference Information System(s)
TA	technical assessment

I. Introduction and summary

A. Overview

1. This report covers the TA of the voluntary submission of Gabon on its proposed FRL,¹ submitted on 8 February 2021, in accordance with decisions 12/CP.17 and 13/CP.19. The remote TA² took place from 19 to 23 April 2021 and was coordinated by the secretariat.³ The TA was conducted by two land use, land-use change and forestry experts from the UNFCCC roster of experts⁴ (hereinafter referred to as the AT): Markus Didion (Switzerland) and Thelma Krug (Brazil). In addition, Gervais Ludovic Itsoua Madzous, an expert from the Consultative Group of Experts, participated as an observer⁵ during the remote session. The TA was coordinated by Sabin Guendehou (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, Gabon submitted its proposed FRL on a voluntary basis. The proposed FRL is one of the elements⁶ to be developed when implementing 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 FRL, as referred to in decision 12/CP.17, paragraph 13, shall be subject to a TA in the context of results-based payments.

3. The objective of the TA is to assess the degree to which the information provided by Gabon is in accordance with the guidelines for submissions of information on reference levels⁷ and to offer a facilitative, non-intrusive, technical exchange of information on the construction of the FRL with a view to supporting the capacity of Gabon to construct and improve its FRL in the future, as appropriate.⁸

4. The TA of the FRL submitted by Gabon was undertaken in accordance with the guidelines and procedures for the TA of submissions from Parties on proposed FRELs and/or FRLs.⁹ This report on the TA was prepared by the AT following the same guidelines and procedures.

5. Following the process set out in those guidelines and procedures, a draft version of this report was communicated to the Government of Gabon. The facilitative exchange during the TA allowed Gabon to provide clarifications and additional information, which were considered by the AT in the preparation of this report.¹⁰ As a result of the facilitative interactions with the AT during the TA, Gabon provided a modified version of its submission on 6 October 2021, which took into consideration the technical input of the AT. The modifications improved the clarity and transparency of the submitted FRL without needing to alter the approach used to construct it. This TA report was prepared in the context of the modified FRL submission. The modified submission, containing the assessed FRL, and the original submission are available on the UNFCCC website.¹¹

B. Proposed forest reference level

6. In decision 1/CP.16, paragraph 70, the COP encouraged developing country Parties to contribute to mitigation actions in the forest sector by undertaking a number of activities, as deemed appropriate by each Party and in accordance with their respective capabilities and

¹ The submission of Gabon is available at <https://redd.unfccc.int/submissions.html?country=gab>.

² Owing to the circumstances related to the coronavirus disease 2019, the TAs of the FREL and FRL submissions of developing country Parties in 2021 had to be conducted remotely.

³ As per decision 13/CP.19, annex, para. 7.

⁴ As per decision 13/CP.19, annex, paras. 7 and 9.

⁵ As per decision 13/CP.19, annex, para. 9.

⁶ See decision 1/CP.16, para. 71(b).

⁷ Decision 12/CP.17, annex.

⁸ Decision 13/CP.19, annex, para. 1(a–b).

⁹ Decision 13/CP.19, annex.

¹⁰ As per decision 13/CP.19, annex, paras. 1(b), 13 and 14.

¹¹ <https://redd.unfccc.int/submissions.html?country=gab>.

national circumstances, in the context of providing adequate and predictable support. The FRL proposed by Gabon, on a voluntary basis for a TA in the context of results-based payments, covers 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 five activities referred to in that paragraph. Pursuant to paragraph 71(b) of the same decision, Gabon developed a national FRL that covers its entire territory. For its submission, Gabon applied a stepwise approach to developing its FRL in accordance with decision 12/CP.17, paragraph 10. The stepwise approach enables Parties to improve their FRELs or FRLs by incorporating better data, improved methodologies and, where appropriate, additional pools.

7. The national FRL proposed by Gabon for 2010–2018 is the average of the annual net CO₂ removals for all REDD+ activities, in the historical period 2000–2009, adjusted by 10 per cent. The AD used in constructing the national FRL were extracted from a historical time series of land-use maps developed by the Ministry of Environment for 1990, 2000 and 2008 and other national land-use data. The EFs were obtained from Gabon’s national resource inventory, additional measurements and IPCC default values. The FRL proposed in the modified submission, with the aim of accessing results-based payments for REDD+ activities for 2010–2018, corresponds to –96,468,186 t CO₂/year, including a 10 per cent adjustment.

8. Gabon applied an adjustment of 10 per cent to the average of the annual net removals of –107,186,873 t CO₂/year (difference between removals of –142,259,005 t CO₂/year and emissions of 35,072,131 t CO₂/year),¹² resulting in the proposed FRL of –96,468,186 t CO₂/year for 2000–2009.

9. The proposed FRL includes the pools above- and below-ground biomass, deadwood and litter and excludes the soil organic carbon pool. Regarding GHGs, the submission includes CO₂ only.

10. Gabon provided the spreadsheets used in constructing the FRL, with comprehensive background data and information on the steps involved in deriving the FRL estimate. The spreadsheets and associated references provided in the submission enabled the AT to reconstruct the FRL, which enhanced the completeness and transparency of the Party’s submission.

II. Data, methodologies and procedures used in constructing the proposed forest reference level

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

1. Information used by the Party in constructing its forest reference level

11. Gabon’s forests are categorized as “tropical rainforest” and subdivided at the national level into dense forest, secondary forest, flooded forest and mangrove forest. In its submission, Gabon provided the definitions of each subcategory, as well as the definitions of further subcategories identified by the Party in order to better align the forest types with the most appropriate country-specific EFs and RFs. The further subcategories are old-growth forest, old secondary forest (20 to 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 (LF₁₀); and logged forest between 11 and 25 years old (LF₂₅)), mangrove forest, colonizing forest and degraded forest. Dense forest comprises old-growth forest, old secondary forest, older logged forest and logged forest (LF₂₅); and secondary forest includes young secondary forest, logged forest (LF₁₀), colonizing forest and degraded forest. Flooded forest and mangrove forest do not include any further subcategories.

¹² In its original submission, Gabon proposed a national FRL of –107,839,499 t CO₂ eq/year for 2000–2009. The difference between the original and the modified submission is due mostly to the inclusion of the dead organic matter pool and post-deforestation carbon stocks in forest land converted to cropland and grassland.

12. Gabon subdivided land into one of the following land tenure classes: logging concessions, protected areas, rural areas, agricultural areas, community forests and conservation set-aside zones. Any land that does not fall into one of these six land tenure classes is labelled as unallocated land. The Party combined conservation set-aside zones, agricultural areas and unallocated land into a single category referred to as other land tenure, and combined community forests with logging concessions. Gabon acknowledged in its submission an allocation error of 200,000 ha of land under logging concessions to unallocated land between 2015 and 2018 and indicated that this error will be corrected in the next submission. The Party used the land tenure classes to identify the REDD+ activities for which emissions and removals are reported for the purposes of the FRL.

13. For constructing its FRL, Gabon applied the 2006 IPCC Guidelines and used the 2019 Refinement to the 2006 IPCC Guidelines solely for guidance purposes, where necessary. AD were obtained to estimate biomass carbon losses and gains in forest land converted to other land uses (deforestation) and forest land remaining forest land (forest degradation) and for logging in forest land remaining forest land. For both deforestation and forest degradation, the AD were extracted from remotely sensed data and volume production estimates for logging. AD were provided for each land tenure class, IPCC land-use category, REDD+ activity and forest type. EFs (including EFs for carbon losses and RFs for carbon gains) were obtained separately for the different forest types and land tenure classes to improve accuracy. Gabon used primarily country-specific data derived from the national resource inventory, as well as measurements obtained from logging concessions and AfriTRON. As no observations were available to estimate carbon gains in mangrove forest and young secondary forest, IPCC default values were used instead.

14. Individual FRLs were constructed for each of the five REDD+ activities and CO₂ emissions and removals were estimated for each IPCC land-use category, land tenure class and forest type. Gabon provided a 10-year historical reference period centred around 2005 (2000–2009), which includes the net CO₂ removals from the five REDD+ activities. The national FRL is presented in the context of results-based payments for 2010–2018.

15. The AD for all forest-cover change (except changes resulting from logging activities) were derived from remotely sensed data products generated by SIRS. The accuracy and uncertainty of the wall-to-wall forest-cover maps produced for 1990, 2000, 2010 and 2015 were assessed using samples following the semi-random sampling method in Sannier et al. (2014). The sampled data were also used to produce additional forest-cover area and change statistics for intervening years (2005 and 2018). Data for 1990 were used directly from the results in Sannier et al. with no further analysis, which resulted in differences between the assessment for 1990–2000 and the other periods (2000–2010, 2010–2015 and 2015–2018).

16. For logging activities, the AD used by Gabon were based on the volume method. The Party explored other potential sources of data, such as the area-based method and remotely sensed data, but these were deemed to be inadequate in view of the need for data at the national level and for long historical time periods, and in order to avoid under- or overestimation. For the volume-based method used to estimate the logged area, Gabon conducted a study to produce a single time series after comparing the declared timber production volumes with the exported volumes and identifying any unregistered or undeclared timber in the production volume data. An adjusted production volume time series was generated by taking the highest value from the registered production volume and the exported value for each year. There were only three years in which the exported volume was slightly higher than the production volume (by about 6 per cent on average).

17. Gabon developed EFs for carbon losses and RFs for carbon gains for different forest types (see para. 13 above) and for each REDD+ activity and land-use conversion type. EFs and RFs were estimated for trees with a diameter at breast height greater than 10 cm using a pantropical model to estimate tree volume (Chave et al., 2014), wood densities derived from the Global Wood Density database (Zanne et al., 2009) to convert tree volume to biomass, root-to-shoot ratios for tropical moist forest (Mokany et al. 2006) and a value from Martin et al. (2018) for wood carbon concentration for tropical forest. The volume estimates were based on tree height estimated using a country-specific model that compares diameter at breast height to height. A country-specific model to estimate tree volume was available but was considered by Gabon to be less accurate owing to the limited number of measurements

used for its development. The AT considers the further development of this country-specific model as an area for future technical improvement.

18. Currently, Gabon does not account for emissions from mangrove forest owing to lack of robust data. The AT notes the information provided by Gabon regarding an ongoing study that is expected to provide relevant data. The AT commends Gabon for identifying this as an area for future technical improvement.

19. For forest land converted to non-forest land (deforestation), the Party derived the EFs for secondary forest as an average of secondary, old-growth and logged forest to account for forest between 20 and 100 years old since disturbance and older forest, respectively. The EFs for secondary and old-growth forest were based on data obtained from the national resource inventory, while the EFs for logged forest were based on measurements obtained from logging concessions. The EFs used for conversions from forest land to other land uses do not include carbon stocks for the respective land-use category after deforestation. Gabon considers changes observed for at least 10 years as permanent. This deviation from the IPCC default conversion period of 20 years is justified considering the faster biomass recovery in tropical forests.

20. In the modified submission, Gabon included post-disturbance carbon stocks for above- and below-ground biomass for conversions to cropland and grassland; post-disturbance carbon stocks for other land categories were assumed to be zero. For cropland, the above-ground biomass carbon stocks after conversion were estimated using expert judgment based on a weighted mean of perennial and annual crops. Oil palm, rubber and other crops (shaded perennial and tropical – all regions) were considered perennial crops and the corresponding data on carbon stocks were obtained from the national literature (e.g. data for oil palm were obtained from RSPO, 2015) or estimated based on the biomass accumulation rates provided in the 2019 Refinement to the 2006 IPCC Guidelines (vol. 4, tables 5.3 and 5.2 for rubber and other crops, respectively). Below-ground carbon biomass for the three types of perennial crops was estimated using data from the relevant literature (for oil palm: RSPO, 2015; rubber: Brahma et al., 2018; and other crops: the 2019 Refinement to the 2006 IPCC Guidelines). The biomass carbon stocks of annual crops were assumed to be zero. For grassland, the above- and below-ground biomass stocks after conversion were based on IPCC default values from the 2006 IPCC Guidelines (vol. 4, table 6.4) and converted to carbon using a value obtained from Martin et al. (2018) for wood carbon content for tropical forests. Deadwood and litter carbon stocks after conversion of forest land to cropland and grassland were assumed to be zero.

21. For forest land remaining forest land, the EFs for carbon losses (forest degradation) were estimated as the difference between the average EF for forest older than 100 years since disturbance and the EF for forest between 20 and 100 years old since disturbance. For land within the land tenure logging concessions, the EFs account for the extracted wood, as well as for losses due to damage during harvest and infrastructure construction. The RFs for carbon gains were based on measurements and the literature. The RFs applied to sustainable forest management for carbon gains on forest land remaining forest land were based on country-specific measurements and supplementary data from measurements conducted in the Central African Republic, which were evaluated in terms of their suitability for forests in logging concessions in Gabon. In addition, data from the literature were used for young secondary forest in logging concessions where the history of disturbance was not known. The RFs for carbon gains applied to forest land remaining forest land for the activities reducing emissions from forest degradation, enhancement of forest carbon stocks and conservation of forest carbon stocks were based either on data from the national forest inventory or on other national field data, except for mangrove forest and young secondary forest. The RFs for forest land remaining forest land for the activities reducing emissions from forest degradation, enhancement of forest carbon stocks and conservation of forest carbon stocks were based on tree increment measured from repeated observations, while the RFs for carbon gains in mangrove forest were based on values in the *2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands* and those for young secondary forest were based on values from the literature. The RFs for carbon gains on land converted to forest land were based on data from the literature for young secondary forest and field measurements for colonizing forest.

22. Currently, Gabon does not account for plantation forests since only a few exist or are included under the agriculture sector, such as oil and rubber palm plantations. Since Gabon foresees the creation of plantations in the future, the AT considers the development of methodologies to account for emissions and removals from plantations as an area for future technical improvement.

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

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

23. The AT recognizes the complexity of Gabon's submission and acknowledges the efforts made by the Party to provide transparent information on the assumptions made, definitions used and methodological constraints in constructing the FRL. The AT commends the Party for the clarifications provided and for providing in the modified submission comprehensive calculation spreadsheets used in constructing the FRL, which enabled the AT to reconstruct the FRL and increased the transparency of the submission.

24. Gabon applied an adjustment of 10 per cent to the annual average net removals for 2000–2009. In response to a question raised by the AT, Gabon explained in the modified submission that there is substantial justification for applying the maximum allowed adjustment as per the Green Climate Fund REDD+ results-based payment methodology for countries with high forest cover and low deforestation. The justification is based on a set of measures taken by Gabon to protect the natural environment and on policies implemented by the country in the 2000s that led to drastic emission reductions in the forestry sector from 2007 onward. The AT is of the view that an adjustment, if applied, should be based on projected changes in net removals due to national circumstances during the crediting period, in accordance with decision 13/CP.19, annex, paragraph 2(h). The AT also notes that the simple application of the maximum allowed adjustment following the Green Climate Fund REDD+ results-based payment methodology is not per se a justification for the use of that level of adjustment. The AT identifies as areas for future technical improvement the justification of the percentage applied in the adjustment and the need to adjust future removals by taking into consideration Gabon's national circumstances.

25. Parallel to the FRL submitted for the average net CO₂ emissions, Gabon also included in the submission a separate calculation for the annual gross CO₂ emissions for the same historical period, equal to 35,072,131 t CO₂/year. The application of the 10 per cent adjustment to this value led to the estimate of adjusted average annual gross emissions of 38,579,344 t CO₂/year. Gabon explained that this calculation was included for comparison only and that the only FRL to be considered for results-based payments was that estimated on the basis of the average annual net CO₂ removals (see para. 24 above). The AT suggests that, in future submissions, Gabon avoid referring to FRL parallel calculations that are not intended to be used for the purpose of results-based payments under the UNFCCC. Despite this, the AT acknowledges that the calculations included for gross CO₂ emissions were reproducible.

26. To derive the AD for the forest area, Gabon used, among others, Landsat data with a spatial resolution of 30 m. The AT noted that Gabon's forest definition sets a minimum tree width of 20 m and a minimum tree height of 5 m and raised a question regarding the adequacy of Landsat data to identify these thresholds. Gabon explained that whenever Landsat images with a spatial resolution of 30 m were used, where possible, segments of Landsat imagery were calibrated against very high-resolution images, assuming a direct correlation between crown cover, height and tree density. The AT commends Gabon for providing this information in the modified submission but noted that no accuracy information was provided. The AT is of the view that the methodology used to map the forest area using these criteria is an area for future technical improvement, for example by using auxiliary data such as LiDAR data.

27. The AT commends Gabon for providing in the modified submission estimates for deadwood and litter carbon stocks using a tier 1 approach to identify the possible significance

of these pools and notes the use of a higher-tier approach to estimate deadwood and litter as an area for future technical improvement.

28. The AT also commends Gabon for considering in the modified submission the post-deforestation carbon stocks for forest land converted to cropland and grassland, which increased the accuracy of the submission. The AT notes that Gabon applied the carbon conversion factors from Martin et al. (2018) developed for woody biomass in forests to convert biomass in grassland to carbon stocks. The AT identified the development of conversion factors to convert biomass in grassland to carbon stocks as an area for future technical improvement.

29. In the original submission, Gabon accounted for all carbon biomass losses in protected areas under the activity conservation of forest carbon stocks. The AT commends Gabon for including in the modified submission the losses in protected areas under the activities reducing emissions from deforestation and reducing emissions from forest degradation, as suggested by the AT.

30. The AT noted that, in the original submission, Gabon estimated the EFs for logging based on the merchantable part of the stem only, excluding merchantable branch wood and non-merchantable tree elements, such as small branches. The AT commends the Party for providing clarifications in the modified submission and for considering the refinement of the EFs for logging by including all the components of logged trees in its improvement plan.

31. The AT commends Gabon for considering country-specific circumstances and for revising generic methods accordingly, such as the IPCC default conversion period of 20 years. The AT notes that Gabon considered 10-year-old secondary forest as stable and applied removal rates estimated from data collected on 18 plots harvested 9–10 years prior to the sampling. For secondary forest between 11 and 25 years old, Gabon used data gathered by the Central African Republic. The AT considers the sampling of secondary forest as an area for future technical improvement to ensure the representativeness of the data.

32. Gabon considered the most important sources of uncertainty associated with the AD, EFs and RFs. The Party provided this information consistently and applied the error propagation methods from the 2006 IPCC Guidelines (vol. 1, equations 3.1 and 3.2), as well as the 2019 Refinement to the 2006 IPCC Guidelines (vol. 1, equations 3.1 and 3.2).

33. During the technical exchange with the AT, the comparatively high uncertainty reported for the AD was discussed. Gabon indicated that this is the result of the small surface areas where individual changes occurred and that, as part of its improvement plan, the sampling intensity will be increased in the future. The AT commends the Party for its plans to reduce the uncertainty of the AD. The AT noted that in the modified submission the reported uncertainty was based on one standard error rather than on the commonly applied two standard errors, which the Party reported in the original submission. The AT notes that the consequent reduction in the uncertainty estimate is hence only a mathematical artefact rather than a methodological improvement. The AT considers the reduction of uncertainties as an area for future technical improvement.

34. Gabon identified forest degradation due to illegal logging and fuelwood collection as a source of uncertainty that could be improved. The AT commends Gabon for identifying the improved incorporation of data on illegal logging and fuelwood collection in the uncertainty analysis as an area for future technical improvement.

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

35. Gabon included information in its submission on a range of policies and plans, including the Sustainable Development Law adopted in 2014, which contains a pillar on sustainable forest management, certified timber production, agriculture and livestock development, and sustainable fisheries, the National Climate Plan, the National Land-Use Plan and the Knowledge and Preservation of National Resources programme. The National Land-Use Plan is cross-ministerial and Gabon's primary tool for implementing the national sustainable development policy and optimizing management of the national territory, with the aim of promoting development while contributing to the prevention of climate change. In addition to the Emerging Gabon Strategic Plan, a number of legislative and policy measures

have been developed to improve forest and land governance which have already contributed to reducing Gabon's carbon emissions from the forest sector. Forests are regulated by the Forestry Code of 2001, which introduced a requirement of sustainable management plans for logging concessions to be implemented by 2006, the National Parks Law of 2007, the Environment Code of 2014 and the Sustainable Development Law. Other relevant policy decisions include a ban introduced in 2010 on exporting raw timber, the Forest and Environment Sector Programme, the National Action Plan to Reduce Illegal Logging and a policy being implemented to manage the environmental and social impacts of palm oil production.

3. Pools, gases and activities included in constructing the forest reference level

36. According to decision 12/CP.17, annex, paragraph (c), reasons for omitting a pool or activity in constructing the FRL should be provided, noting that significant pools and activities should not be excluded.

37. The pools included in the Party's FRL are above- and below-ground biomass, applying tier 2 and 3 methods, and dead organic matter (litter and deadwood) applying a tier 1 approach. The soil organic carbon pool was not included. The AT considers the estimation of soil organic carbon stocks as an area for future technical improvement.

38. For soil organic carbon in forest land remaining forest land, Gabon applied the IPCC default assumption of no change. For forest land converted to other land-use categories, Gabon considered that changes in soil organic carbon are currently insignificant and provided in the submission a detailed rationale for their exclusion, as well as an indication that the collection of country-specific data on changes in soil organic carbon due to land use and management is planned as a future improvement. The AT considers that the exclusion of the soil organic carbon pool was adequately justified by Gabon considering the large variability and uncertainty of this pool. The AT commends Gabon's intention to obtain more accurate data and information on this pool in order to include it in future FRL submissions as part of the stepwise approach. The AT considers the estimation of emissions from dead organic matter using a higher-tier method and the inclusion of the soil organic carbon pool in the FRL as an area for future technical improvement.

39. As a result of the technical exchange during the TA, Gabon included in the modified submission an estimate of CO₂ emissions from deadwood, based on measurements conducted on 47 samples from the national resource inventory plots, and from litter using IPCC default values for tropical forests from the 2006 IPCC Guidelines. The AT commends Gabon for including these pools in the modified submission.

40. Gabon did not include non-CO₂ gases in the FRL. In response to a question raised by the AT, the Party indicated that there are no reliable statistics on forest fires in Gabon due to the high cloud cover and explained that anthropogenic fires are common in the dry season but occur mainly in savannahs and rarely affect forests. Published data consulted by the Party (e.g. Verhegghen et al., 2016) indicate that "while observations of fire in tropical forests are frequent in Amazonia or Indonesia, few records of fire are found for Central Africa". In addition, the AT identified that nitrous oxide emissions from mineralization of nitrogen in soil organic matter following land-use change on mineral soils were not included in the FRL. The AT considers the treatment of non-CO₂ gases as an area for future technical improvement to ensure the completeness of the FRL.

41. Overall, the AT commends Gabon for providing estimates of CO₂ emissions and removals separately for each of the five REDD+ activities, which the AT considers to be relevant to understand the effectiveness of the policies, measures and actions implemented by Gabon in its national territory. The AT acknowledges the Party's intention to improve future FRL submissions when new and adequate data and better information become available as part of the stepwise approach.

4. Definition of forest

42. Gabon provided in its submission the following definition of forest used in constructing its FRL: "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 meters high at maturity, but not subject to

any agricultural practice. It does not include land that is predominantly under agricultural or urban land-use". All forest land in Gabon is considered managed, under the Forestry Code of 2001.

43. Gabon indicated in its submission that the national forest definition used in constructing its FRL is not consistent with the forest definition used for its reporting to FAO for the Global Forest Resources Assessment (i.e. minimum area of 1 ha, height of 5 m or more and at least 30 per cent canopy cover), but is the same as that used for its national GHG inventory. The definition used for the national GHG inventory and in constructing its FRL is better aligned with the spatial resolution of the remote sensing data used. The AT welcomes Gabon's intention to ensure consistency in the future between the reporting to the UNFCCC and to FAO for the Global Forest Resources Assessment.

III. Conclusions

44. The information used by Gabon in constructing its FRL for the five REDD+ activities is transparent and complete and in overall accordance with the guidelines for submissions of information on reference levels.

45. The adjusted FRL presented in the modified submission, for the reference period 2000–2009, corresponds to –96,468,186 t CO₂/year.

46. The AT acknowledges that Gabon included in its FRL the most significant pools in terms of emissions from forests. The AT considers that, in doing so, Gabon followed decision 1/CP.16, paragraph 70, on activities undertaken, and decision 12/CP.17, paragraph 10, on applying the stepwise approach.

47. As a result of the facilitative interactions with the AT during the TA, Gabon provided a modified submission that took into consideration the technical input of the AT. The AT notes that the transparency and completeness of the information provided were significantly improved in the modified FRL submission, without having to alter the approach or values used to construct the FRL, and commends Gabon on its efforts. The new information provided in the modified submission, including the spreadsheets containing detailed information on how the estimates of CO₂ emissions from all REDD+ activities were calculated, increased the reproducibility of the FRL calculations.

48. The AT notes that, overall, Gabon maintained consistency, in terms of sources of AD and EFs used for its FRL, with those used for the GHG inventory included in its second national communication (submitted in 2011).¹³ There were some justified exceptions, such as the exclusion of the soil organic carbon pool, the use of a different forest definition from that used for its reporting to FAO for the Global Forest Resources Assessment and the use of data from the national resource inventory, which became available after the preparation of the Party's second national communication and the publication of the FAO Global Forest Resources Assessment.

49. The AT notes that the application of the maximum allowable adjustment of 10 per cent to the average of the annual net CO₂ removals should be sufficiently justified, including the need for the application of an adjustment to future net removals, based on Gabon's national circumstances (see paras. 24–25 above).

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

- (a) Improving and applying the country-specific tree volume model (see para. 17 above);
- (b) Developing carbon conversion factors to convert biomass in grassland to carbon stocks (see para. 28 above);
- (c) Obtaining EFs including the carbon content of non-woody biomass (see para. 30 above);

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

- (d) Ensuring the representativeness of data through the sampling of secondary forest (see para. 31 above);
- (e) Reducing the uncertainty of the AD for REDD+ activities (see para. 33 above);
- (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 (see paras. 17, 19 and 21 above);
- (g) Developing methods to account for emissions and removals from forest plantations (see para. 22 above);
- (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 (see para. 26 above);
- (i) Sampling secondary forest to ensure the representativeness of data on removal rates (see para. 31 above).

51. Pursuant to decision 13/CP.19, annex, paragraph 2(f), in assessing the pools and gases included in the FRL, the AT noted that the pools and gases excluded by Gabon are likely to be insignificant in the context of the FRL. Nevertheless, pursuant to decision 13/CP.19, annex, paragraph 3, the AT identified the following additional areas for future technical improvement regarding pools and gases excluded from the FRL:

- (a) Treatment of the deadwood and litter pools using a higher-tier method to improve accuracy (see para. 38 above);
- (b) Treatment of the soil organic carbon pool in constructing the FRL (see paras. 37–38 above);
- (c) Treatment of non-CO₂ 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 (see para. 40 above).

52. The AT acknowledges and welcomes the Party's intention to:

- (a) Incorporate data on illegal logging and fuelwood collection as causes of degradation in the uncertainty analysis (see para. 34 above);
- (b) Include mangrove forest in the construction of the FRL using relevant data from an ongoing study (see para. 18 above);
- (c) Improve the methodology used to estimate the EFs for logging (see para. 30 above);
- (d) Revisit sample plots to obtain more accurate estimates of tree growth increment (see chap. 15.1 of Gabon's modified submission).

53. In conclusion, the AT commends Gabon for showing strong commitment to continuously improving its FRL estimates in line with the stepwise approach. A number of areas for the future technical improvement of Gabon's FRL 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.¹⁴ The AT also acknowledges that the TA was an opportunity for a rich, open, facilitative and constructive technical exchange of information with Gabon.

54. The table contained in annex I summarizes the main features of Gabon's proposed FRL.

¹⁴ As per decisions 13/CP.19, annex, para. 1(b); and 12/CP.17, para. 10.

Annex I

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

	<i>Main features of the FRL</i>	<i>Remarks</i>
Proposed FRL	-96 468 186 t CO ₂ /year	The proposed FRL for the net CO ₂ removals includes an adjustment of 10 per cent (see paras. 7–8 of this document)
Type and reference period of FRL	FRL = average of historical net removals in 2000–2009	See paragraphs 7–8 of this document
Application of adjustment for national circumstances	Yes	See paragraphs 7–8 and 24–25 of this document
National/subnational	National	The FRL proposed by Gabon covers the entire territory (see para. 6 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 6 of this document
Pools included	Above-ground biomass Below-ground biomass Deadwood Litter	The deadwood and litter pools were estimated using a tier 1 approach. The omission of the soil organic carbon pool was reasonably justified (see paras. 37–38 of this document)
Gas included	CO ₂	No reliable data were available to estimate non-CO ₂ gases (see para. 40 of this document)
Forest definition	Included	Gabon provided the following forest definition in its submission: “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 high at maturity, but not subject to any agricultural practice. It does not include land that is predominantly under agricultural or urban land-use” (see para. 42 of this document)
Consistency with latest GHG inventory	Methods used for estimating the FRL are not consistent with those used for the latest GHG inventory	Among others, this was due to the use of data for constructing the FRL that were not available for the preparation of Gabon’s second national communication (see para. 43 of this document)
Description of relevant policies and plans	Included	Gabon provided information on relevant policies and international commitments (see para. 35 of this document)

<i>Main features of the FRL</i>		<i>Remarks</i>
Description of assumptions on future changes to domestic policy, if included in constructing the FRL	Not applicable	–
Description of changes to previous FRL	Not applicable	–
Identification of future technical improvements	Included	Several areas for future technical improvement were identified, such as those in paragraphs 17–19, 21–22, 26, 28, 30–31, 33–34, 37–38 and 40 of this document

Annex II

Reference documents

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B. UNFCCC documents

First and modified FRL submissions of Gabon. Available at <https://redd.unfccc.int/submissions.html?country=gab>.

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

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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:

Brahma, B., Nath, A.J., Sileshi, G.W., Das, A.K., 2018. Estimating biomass stocks and potential loss of biomass carbon through clear-felling of rubber plantations. *Biomass and Bioenergy* 115, 88–96. <https://doi.org/10.1016/j.biombioe.2018.04.019>.

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Martin, A.R., Doraisami, M., Thomas, S.C., 2018. Global patterns in wood carbon concentration across the world’s trees and forests. *Nature Geoscience* 11, 915–920. <https://doi.org/10.1038/s41561-018-0246-x>.

Mokany K, Raison RJ, Prokushkin AS (2006) Critical analysis of root : shoot ratios in terrestrial biomes. *Global Change Biology* 12:84-96. doi:10.1111/j.1365-2486.2005.001043.x.

RSPO, 2015. RSPO GHG Assessment for New Plantings Olam Palm Gabon, Mouila Lot 3.

Sannier, C., McRoberts, R.E., Fichet, L.-V., Makaga, E.M.K., 2014. Using the regression estimator with Landsat data to estimate proportion forest cover and net proportion

deforestation in Gabon. *Remote Sensing of Environment* 151, 138–148. <https://doi.org/10.1016/j.rse.2013.09.015>.

Verhegghen, A., Eva, H., Ceccherini, G., Achard, F., Gond, V., Gourlet-Fleury, S., Cerutti, P., 2016. The Potential of Sentinel Satellites for Burnt Area Mapping and Monitoring in the Congo Basin Forests. *Remote Sensing* 8, 986. <https://doi.org/10.3390/rs8120986>.

Zanne, A.E., Lopez-Gonzalez, G., Coomes, D., Ilic, J., Jansen, S., Lewis, S.L., Miller, R.B., Swenson, N.G., Chave, J., Wiemann, M.C., 2009. Global Wood Density Database. Data from: Towards a worldwide wood economics spectrum. Dryad Data Repository.
