Technical report on the technical analysis of the technical annex to the first biennial update report of Papua New Guinea submitted in accordance with decision 14/CP.19, paragraph 7, on 17 April 2019

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 Papua New Guinea on 17 April 2019 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" and "enhancement of forest carbon stocks", which are 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 Papua New Guinea in its modified FRL submission of July 2017.

> Papua New Guinea reported the results of the implementation of these activities for 2014–2015, which amount to 3,957,412 (2014) and 5,045,902 (2015) tonnes of carbon dioxide equivalent and were measured against the assessed FRL of 43,369,737 (2014) and 45,049,344 (2015) tonnes of carbon dioxide equivalent.

> The data and information provided in the technical annex are in overall accordance with the guidelines contained in the annex to decision 14/CP.19. The technical analysis concluded that the data and information provided by Papua New Guinea in the technical annex are overall both transparent and consistent with the assessed FRL established 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.

Contents

Abbreviations and acronyms

AD	activity data
BUR	biennial update report
CE	Collect Earth
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
EF	emission factor
FRL	forest reference level
GHG	greenhouse gas
IPCC	Intergovernmental Panel on Climate Change
LULUCF	land use, land-use change and forestry
MRV	measurement, reporting and verification
NFI	national forest inventory
NFMS	national forest monitoring system
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
2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*

I. Introduction

A. Introduction

1. This technical report covers the TA of the technical annex provided by Papua New Guinea on 17 April 2019 in accordance with decision 14/CP.19, paragraph 7, included in the first BUR of Papua New Guinea, which was submitted in accordance with decision 2/CP.17, paragraph 41(a), and annex III, paragraph 19. In the technical annex, Papua New Guinea provided the data and information used for estimating its anthropogenic forest-related emissions by sources and removals by sinks, forest carbon stocks, and forest carbon stock and forest area changes resulting from the implementation of 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 Peter Iversen (secretariat).

2. 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 Papua New Guinea and through a facilitative sharing of views, resulting in a separate summary report.[1]

3. Papua New Guinea made its first FRL submission, in accordance with decision 12/CP.17, on 15 January 2017, which was subject to a technical assessment following the guidance provided in decision 13/CP.19 and its annex. Taking into consideration the technical inputs of the assessment team, Papua New Guinea submitted a modified version of its proposed FRL on 10 July 2017. 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 the annex to decision 14/CP.19. The findings from the technical assessment of the FRL are included in a separate report.[2]

B. Process overview

4. The TA of the first BUR of Papua New Guinea took place from 2 to 6 September 2019 in Bonn 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: Ahmad Wafiq Aboelnasr (Egypt), Kwame Agyei (Ghana), Rehab Ahmed Hassan (Sudan), Nura Al-Otaibi (Saudi Arabia), Nicolo Macaluso (Canada), Tahira Munir (Pakistan), Raul Salas Reyes (Mexico) and Maarten van der Eynden (Norway). Mr. Agyei and Mr. van der Eynden were the LULUCF experts who undertook the TA of the technical annex in accordance with decision 14/CP.19, paragraphs 10–13.

5. The TA of the technical annex provided by Papua New Guinea 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.

6. During the TA and subsequent exchanges, the LULUCF experts and Papua New Guinea engaged in technical discussions, and Papua New Guinea provided clarifications in response to the questions raised by the LULUCF experts, in order to reach a common understanding on the identification of the capacity-building needs of the Party and areas for technical improvement.

7. Following the TA of the technical annex, the LULUCF experts prepared and shared the draft technical report with Papua New Guinea for its review and comments. The LULUCF experts responded to the Party's comments and incorporated them into and finalized this technical report in consultation with Papua New Guinea.

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[1] FCCC/SBI/ICA/2019/TASR.1/PNG (preparation under way at the time of the preparation of this report).

[2] FCCC/TAR/2017/PNG, published on 2 March 2018.

C. Summary of results

8. 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, Papua New Guinea, on a voluntary basis, proposed a national FRL covering the activities "reducing emissions from deforestation", "reducing emissions from forest degradation" 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 Papua New Guinea's national territory. The assessed FRL of Papua New Guinea amounts to 43,369,737 (2014), 45,049,344 (2015), 46,728,951 (2016), 48,408,557 (2017) and 50,088,164 (2018) t CO_2 eq.

9. The Party's FRL is based on projected emissions of CO_2 for 2014–2018 derived using an equation based on a linear regression model associated with the activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks for the historical reference period of 2001–2013. Papua New Guinea reported the results of the implementation of the activities for 2014–2015, calculated against the FRL for 2014 and 2015, which amount to emission reductions of 3,957,412 (2014) and 5,045,902 (2015) t CO_2 eq.

II. Technical analysis of the information reported in the technical annex to the first biennial update report

A. Technical annex

10. For the technical annex to the first BUR submitted by Papua New Guinea, see annex I.[3]

B. Technical analysis

11. 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) There is consistency in the methodologies, definitions, comprehensiveness and information provided between the assessed FRL and the results of the implementation of 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.

12. The remainder of this chapter presents the results of the TA of the technical annex to the BUR according to the scope outlined in paragraph 11 above.

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

13. In accordance with decision 14/CP.19, paragraph 3, the data and information used by Parties for estimating anthropogenic forest-related emissions by sources and removals by sinks, forest carbon stocks, and forest carbon stock and forest area changes related to REDD+ activities undertaken by them should be transparent and consistent over time and with their established FRL in accordance with decision 1/CP.16, paragraph 71(b) and (c), and decision 12/CP.17, section II.

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[3] In accordance with decision 14/CP.19, para. 14(a).

14.   The LULUCF experts noted that Papua New Guinea ensured overall consistency between its FRL and its estimation of the results of the implementation of the activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks in 2014–2015 by:

(a)   Using consistent methodologies and data to generate AD on the activities. For example, Papua New Guinea visually interpreted satellite images using CE, an open-source tool developed by the Food and Agriculture Organization of the United Nations. The CE tool applies point sampling (in grids of 0.04 and 0.02 degrees) using satellite imagery for classification into the six IPCC land-use categories and various national subcategories. While the assessment was largely conducted using Google Earth Engine, with satellite imagery from Landsat 7 and 8, the Party also relied on Bing maps and other high-resolution imagery available. A set of hierarchical rules was established on the basis of the proportions of area occupied by the different land-use categories and their definitions, and these rules were used to determine the land use by plot;

(b)   Using consistent methodologies and data to generate EFs for both the FRL and results, in particular by using the same two main sources for the EFs applied for the various forest categories. For five of the forest categories, the figures are based on the average above-ground biomass (223 t carbon/ha) derived from a study by Fox et al. (2010) in Papua New Guinea. The EFs for deforestation for the remaining forest categories were default values from the 2006 IPCC Guidelines. The EF applied for forest degradation stemming from all types of disturbance and management practices assumes that the carbon stocks in degraded forests are 65.5 per cent of those in the primary forests. This percentage was estimated on the basis of measurements taken in commercially logged-over low-altitude forests from Fox et al. (2010). CO_2 removals after forest disturbance are assumed to be included in the EF for forest degradation. The removal factor for post-deforestation regrowth in forest land converted to cropland and in forest land converted to grassland with perennial woody vegetation is based on a weighted average of default values of mean annual biomass increment for several crop types and grasslands provided in the 2006 IPCC Guidelines (8.11 t dry matter/year/ha);

(c)   Including the same two carbon pools: above-ground biomass and below-ground biomass;

(d)   Including the same gas: CO_2;

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

(f)   Using the same forest definition as that used in constructing its FRL.

15.   In the technical annex, Papua New Guinea introduced a new methodology for the treatment of post-deforestation regrowth. In the assessed FRL, the Party included a post-deforestation removal factor of –13.98 t CO_2/ha/year based on post-deforestation land use as identified using CE for 2001–2013. The removals for each year were then calculated on the basis of the accumulated deforestation observed since 2001. These removals were then projected linearly and deducted from the gross emissions associated with deforestation to determine the net emissions from deforestation. In the technical annex, Papua New Guinea explained that the linear projection of post-deforestation removals in the FRL represented an error since post-deforestation removals follow an exponentially shaped curve for 2014–2015 to take into account the annual accumulated increase in deforestation area. Papua New Guinea also explained that not correcting for this error (i.e. maintaining full consistency with the technical assessed FRL) would have led to results that are systematically overestimated. The LULUCF experts noted that the introduction of the post-deforestation removal correction, which is equal to the difference between the results obtained using a linear curve (as in the assessed FRL) and those obtained using an exponential curve for 2014–2015 (as suggested in the technical annex), has resulted in fewer results reported for 2014–2015 owing to the lower net emissions included in the FRL during the results period. However, the LULUCF experts also noted that the Party's assessed FRL is a linear projection of the total net emissions from the implementation of the three activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks, and therefore did not include the exponential curve described in the technical annex related to post-deforestation removals. This represents an inconsistency between the assessed FRL and the technical annex. In response to a question from the LULUCF experts, Papua

New Guinea stated that future FRLs may include the proposed updated method for treating post-deforestation removals, and that data from a longer historical time period may be used. The LULUCF experts commend Papua New Guinea for its efforts to increase the accuracy of the estimated results over time and for its plans to further increase consistency between future FRL submissions and results in line with the stepwise approach.

16.   In view of the above, the LULUCF experts concluded that the results presented of the implementation of the activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks are largely consistent with the assessed FRL. They commend Papua New Guinea for planning to further increase the consistency of the data and methodologies described in the FRL submission for 2014–2018 and in the technical annex with the results of the implementation of the activities for 2014–2015.

17.   Shortly before the start of the centralized TA session, Papua New Guinea submitted an annex to its technical annex, describing how its FRL and results could be recalculated in the context of a future submission to the REDD+ results-based payments pilot programme of the Green Climate Fund. The LULUCF experts noted that the technical assessment of this new information is beyond the scope of this technical assessment in accordance with decision 14/CP.19, paragraph 11.

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

18.   The LULUCF experts noted that, as part of the TA process, Papua New Guinea provided additional information, in particular on the methods and procedures relating to the use of the CE tool, as well as spreadsheets showing the detailed calculations of AD, EFs and uncertainty levels, and the general steps of the statistical procedures. The Party also provided spreadsheets containing information from the analysis of all sample plots assessed while calculating AD. The LULUCF experts commend Papua New Guinea for its efforts to increase the transparency and improve the completeness[4] of the data and information provided, allowing for the reconstruction of the results.

19.   The LULUCF experts also noted, however, that Papua New Guinea's technical annex and supplementary information did not provide a detailed description of the statistical procedure for estimating AD from the CE sample plots, or the raw data used for estimating AD. They further noted that this is an area for technical improvement and that the Party may wish to include this information in future submissions to increase transparency and completeness.

20.   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 Papua New Guinea's FRL noted that the Party did not maintain consistency with the GHG inventory available at that time.[5] The LULUCF experts noted that the consistency between the FRL and the GHG inventory included in Papua New Guinea's first BUR had increased, most notably owing to its use of the CE tool to estimate AD for both the technical annex and LULUCF. However, inconsistencies remain as the national GHG inventory includes additional gases (methane and nitrous oxide), carbon pools (litter and soil organic carbon) and other methodological differences (inclusion of biomass regrowth of forests degraded prior to 2000 and inclusion of fuelwood gathering) that are not included in the technical annex. The LULUCF experts commend Papua New Guinea for its efforts to improve consistency between the FRL and the national GHG inventory, and noted increasing consistency as an area for future technical improvement.

21.   In its technical annex, Papua New Guinea describes how anthropogenic and non-anthropogenic forest change is separated in the AD analysis. This separation is based on where change events are observed. If the change is observed in an inaccessible area, the change is assumed to be non-anthropogenic. The local knowledge and experience of the officer conducting the analysis form the basis of these considerations. In response to a

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[4] "Complete" here means the provision of the information necessary for the reconstruction of the results.

[5] FCCC/TAR/2017/PNG.

question from the LULUCF experts, Papua New Guinea clarified that there are no detailed guidelines available for this process, but that the analysis is supported by ancillary data such as on concession boundaries and roads. The LULUCF experts noted that developing clearer guidelines for operators on determining whether change events are anthropogenic or non-anthropogenic is an area for future technical improvement. They also noted that an indication by the Party of the extent of non-anthropogenic change events could also increase the accuracy and transparency of future submissions.

22.   In the AD analysis using the CE tool, operators use a set of hierarchical rules to determine the land use of plots in instances where there are multiple land uses in the area of interest. Each land-use category has a threshold that needs to be met in order for it to be categorized using a hierarchical rule. For forest, this threshold is 30 per cent. The LULUCF experts asked the Party whether the adoption of the 30 per cent threshold for forest land under the hierarchical rule was consistent with the national forest definition, which specifies a crown cover threshold of 10 per cent. Papua New Guinea confirmed that the threshold used in the AD analysis is 30 per cent, and that this may lead to inconsistencies compared with the national forest definition. The Party indicated that the national forest definition is mainly used to guide the management of forests by the Papua New Guinea Forest Authority and that it will discuss the matter further internally to improve consistency in the application of the forest definition in future submissions. The LULUCF experts welcome Papua New Guinea's plans to further increase consistency between the AD analysis and the national forest definition in the future.

23.   The LULUCF experts concluded that the Party provided the necessary information to facilitate their understanding of the estimation of the results of the implementation of the activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks. The data and information provided in the technical annex are overall considered to be transparent, consistent, complete and accurate to the extent possible. However, the absence of a clear description of the statistical procedure used to estimate AD on the basis of the sample plots, and of the raw data used to generate AD, meant it was not possible to fully reconstruct the results. The LULUCF experts noted this as an area for technical improvement that would increase the transparency and completeness of future submissions.

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

24.   Papua New Guinea provided data and information on all the required elements in accordance with the guidelines contained in the annex to decision 14/CP.19, namely summary information from the final report containing the assessed FRL; results in t CO_2 eq per year, which are overall consistent with the assessed FRL; a demonstration that the methodologies used to produce the results are overall consistent with those used to establish the assessed FRL (as outlined in chap. II.B.1 above); a description of forest monitoring systems and the institutional roles and responsibilities in the MRV of the results; much of the information necessary for the reconstruction of 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) and (d), have been taken into account.

25.   In its submission, Papua New Guinea provided a summary table with the results of the implementation of the activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks for 2014–2015, overall consistent with the assessed FRL but not fully allowing for the reconstruction of the results. The results achieved are listed in table 3.1 of the technical annex and amount to 3,957,412 (2014) and 5,045,902 (2015) t CO_2 eq.

26.   The LULUCF experts noted that the Party provided a description of the NFMS and a summary of the institutional roles and responsibilities for the MRV of the results in the technical annex. The roles and responsibilities of the agencies and institutions involved in MRV were transparently explained. During the consultation process, the Party explained that the role of the Papua New Guinea Forest Authority is to provide all AD and EFs to the Climate Change Development Authority, which is then mandated to report the results to the UNFCCC. The LULUCF experts commend Papua New Guinea for sharing this information.

27.   The forest monitoring system used is a national system. The system assesses data related to forest and land use, using statistical methods (CE) and wall-to-wall mapping. Information is also disseminated through the Party's REDD+ and forest monitoring web portal.[6] The Party is in the process of implementing a multipurpose NFI. The LULUCF experts commend Papua New Guinea for its efforts to improve forest data and information in accordance with the stepwise approach.

28.   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. During the consultation process, and in the technical annex, the Party explained that natural forests are stratified into 12 vegetation types, and that plantation forest is stratified as a separate forest category. The categorization of these forest types will be refined further, for example by refining the corresponding EFs, after the implementation of the NFI. The LULUCF experts commend Papua New Guinea for its efforts in this regard.

29.   As the NFMS is national in scope, the LULUCF experts noted that the displacement of forest emissions in the national territory of Papua New Guinea is not an issue as it would be captured by the NFMS.

30.   The Party provided a description of how IPCC guidance and guidelines were taken into account in accordance with decision 4/CP.15, paragraph 1(c). For the estimation of emission reductions, the Party used the methodology provided in the 2006 IPCC Guidelines for estimating carbon stocks in forest land converted to other land uses. Accordingly, the emissions from deforestation and forest degradation were estimated for 2014–2015 by combining AD (i.e. areas of annual deforestation and forest degradation) with the appropriate EF (i.e. emissions associated with the corresponding forest type). Papua New Guinea also included the enhancement of forest carbon stocks in its assessed FRL and technical annex. However, during the assessment week, the Party confirmed that no removals from enhancements of forest carbon stocks were observed either during the reference period or in 2014–2015. It indicated that the enhancement of carbon stocks (mainly through reforestation and afforestation) is a critical component of its national policies and, consequently, has been included in the FRL and results to ensure its continual monitoring in the future using better tools and approaches. The LULUCF experts commend Papua New Guinea for its efforts to improve data collection on carbon stock enhancement activities.

31.   In the technical assessment report on Papua New Guinea's FRL,[7] the reasons for excluding some carbon pools (deadwood, litter and soil organic carbon) and non-CO_2 gases (methane and nitrous oxide) were discussed extensively. The Party provided reasons for omitting these pools and gases, and the team assessing the FRL recommended these issues as areas for future technical improvement. Several of these recommendations are still valid (see paras. 33 and 36 below). The LULUCF experts acknowledge that the Party included in its FRL and technical annex an estimation of the most significant pools and gases on the basis of available information. Areas for technical improvement identified during the assessment of the FRL relating to pools and gases are still valid. The LULUCF experts commend Papua New Guinea for its efforts to obtain better data to address these issues in the future, as part of the stepwise approach, for example through the NFI.

4.   Accuracy of the results proposed in the technical annex

32.   The LULUCF experts noted that the Party's estimation of the results of the implementation of the activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks in the national area of Papua New Guinea was undertaken using, overall, a transparent and consistent approach. The LULUCF experts commend Papua New Guinea for its significant long-term efforts to build a robust NFMS that is capable of providing transparent estimates of emissions and removals from forest-related sources and sinks.

33.   Both the established FRL and the results obtained in 2014–2015 from the implementation of the activities are based on the following key assumptions relating to accuracy:

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[6] http://png-nfms.org/portal/.
[7] FCCC/TAR/2017/PNG.

(a)   The Party estimated EFs for deforestation by deducting the removals from post-deforestation biomass regrowth in cropland and grasslands, calculated using a weighted average of the mean annual increments of above-ground biomass and a root–shoot ratio of 0.37 for coconut, palm oil, shifting cultivation and permanent subsistence agriculture. This approach is an approximation that assumes that past observations provide a good basis for predicting expected emissions over a five-year time-horizon. The LULUCF experts commend Papua New Guinea for including post-deforestation regrowth in its methodology for estimating emissions and removals from deforestation. However, they consider that, to further increase accuracy, Papua New Guinea may wish to use country-specific post-deforestation biomass growth rates for non-forest land uses;

(b)   The Party derived the EFs for forest degradation from the above-mentioned scientific study by Fox et al. (2010). In this study, the carbon stocks in selectively harvested forests were estimated using a random sampling of plots in selectively harvested forests that had been subject to harvesting within the last four years. It was assumed that forest regrowth following forest degradation was included in the EFs used for estimating emissions from forest degradation. However, the LULUCF experts noted that, in tropical regions, biomass may accumulate quickly, thus making it difficult to determine the extent to which the EFs include forest regrowth, because plots may have been established from between a few months to up to four years after logging. This approach may result in a significant level of uncertainty and cause an underestimation of CO_2 removals during the historical reference period. During the TA of the FRL, Papua New Guinea explained that this approach is based on the most comprehensive and reliable data set currently available in the country for estimating GHG emissions from logging activities. The LULUCF experts noted the accurate determination of the extent of forest regrowth included in the EF for degradation as an area for future technical improvement, and commend Papua New Guinea for its ongoing fieldwork, as part of its NFI, to update these EFs;

(c)   The LULUCF experts noted that, when determining above-ground biomass using the study by Fox et al. (2010), Papua New Guinea used a carbon fraction of 0.5 of dry matter. They also noted that this figure differs from the carbon fraction of 0.47 provided in the 2006 IPCC Guidelines (table 4.3) used by the Party in all other sections of both the FRL and the technical annex submissions. The LULUCF experts further noted that Papua New Guinea may consider using the same carbon fraction consistently in subsequent submissions to further enhance the accuracy of future FRL and results submissions;

(d)   For commercial logging, the Party estimated the EFs for forest degradation by assuming that all disturbance types (i.e. logging, fire, grazing, gardening, and 'wokabaut' or portable sawmill) cause the loss of 34.5 per cent of the total biomass carbon stocks of primary forests (this assumption differs only for mangroves). The LULUCF experts noted that this assumes that all types of disturbance affect forest carbon stocks in the same way as commercial logging. They also noted that this assumption may reduce the accuracy of the estimated emissions from forest degradation. Given that disturbances other than logging have historically affected 12.8 per cent of the total forest area in Papua New Guinea, the LULUCF experts consider that accurately determining the losses of biomass carbon stocks resulting from different types of disturbance, including through further research, would enhance the accuracy of future FRLs and results, and noted this as an area for future improvement. They further noted in this regard that, as communicated by the Party during the TA of the FRL, the ongoing NFI covers different disturbance types and as such could potentially provide the data needed to implement this approach;

(e)   For the estimation of emissions and removals from forest degradation, Papua New Guinea assumes that forest degradation occurs only once (i.e. when it is first observed through CE) and that there are no subsequent degradation events in forest areas already subject to degradation. The LULUCF experts noted that this assumption potentially leads to underestimation of the total emissions from forest degradation by excluding emissions from subsequent forest degradation in such areas. Given that disturbances other than logging have historically affected 12.8 per cent of the total forest area in Papua New Guinea, the LULUCF experts consider that the Party tracking lands subject to degradation and including emissions from degradation events subsequent to the first occurrence of degradation in the estimation of emissions from the degradation activity would increase the accuracy of future FRLs and results, and noted this as an area for future improvement. They commend Papua New Guinea

for its efforts to improve the EFs for degradation on the basis of the results of the ongoing NFI;

(f)   The Party identified gardening as a management practice leading historically to forest degradation in 8.2 per cent of the forests in Papua New Guinea. During the TA of the FRL, Papua New Guinea confirmed that forests subject to gardening include small degraded patches of forest isolated from villages and croplands less likely to be affected by natural disturbances (e.g. gentle slopes). The Party explained that these areas could also be abandoned agricultural lands or temporary gardens (e.g. stemming from road construction) and that it was impossible to accurately identify the land use through remote sensing assessments. The Party clarified that it did not report emissions from the further degradation of degraded forest owing to technical limitations and that all disturbances reported during the reference period occurred in primary forests. The team assessing the FRL noted that this suggests that all forests subject to gardening were assumed to be primary forests, and also noted that these regrown forest patches are not likely to contain biomass carbon stocks comparable to primary forests, as a result of which this assumption may lead to overestimation of the emissions from forest degradation. The LULUCF experts therefore consider that Papua New Guinea may wish to estimate and use the actual values of biomass carbon stocks in forests subject to gardening prior to the disturbance rather than those for primary forests, and consider this to be an area for future technical improvement. In this regard, the LULUCF experts noted Papua New Guinea's ongoing efforts to implement its NFI.

34.   In its technical annex, the Party included additional information regarding uncertainties compared with the FRL submission. An overview of standard errors, confidence intervals and uncertainties (expressed as a percentage) was provided for various land use and land-use change categories, using the AD generated through the CE tool. For EFs, uncertainty values derived from Fox et al. (2010) and the default values from the 2006 IPCC Guidelines were used. The approach of propagating errors was used to estimate combined uncertainties of AD and EFs. The LULUCF experts commend Papua New Guinea for its efforts to increase the understanding and transparency of uncertainties. They noted that Papua New Guinea may also wish to consider other methods for performing uncertainty assessments in the future, such as a Monte Carlo simulation, noting this as an area for future technical improvement.

35.   In response to a question from the LULUCF experts regarding the use of a systematic sampling approach instead of more stratified sampling approaches for AD estimation, the Party confirmed that the systematic sampling approach was used to maintain consistency with the assessed FRL, but that other statistical approaches might be considered in the future. The LULUCF experts commend Papua New Guinea for its ongoing efforts to develop its NFMS over time.

C.   Areas identified for technical improvement

36.   The LULUCF experts concluded that the following areas for technical improvement identified in the report on the technical assessment of Papua New Guinea's FRL[8] also apply to the provision of information on the results of the implementation of the activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks:

(a)   Improving consistency between the FRL and the national GHG inventory, including in the selection of methods, data and assumptions, following the guidance provided in the relevant set of IPCC guidelines;

(b)   Including a detailed, step-by-step description of the estimation procedure, including how AD on land use and land-use change are derived from CE (e.g. information on the statistical methods used to derive AD from the CE assessments) to enable the reconstruction of the FRL and results;

(c)   Using country-specific post-deforestation biomass growth rates for non-forest land uses to estimate the EFs for deforestation;

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8   FCCC/TAR/2017/PNG.

(d)   Improving the EFs for forest degradation, including full implementation of the NFI, by:

(i)   Accurately determining the extent of forest regrowth included in the above-ground biomass carbon stocks in selectively logged forest;

(ii)   Accurately determining the losses in biomass carbon stocks in forest areas subject to disturbances other than logging;

(iii)   Tracking forest land subject to degradation and including emissions and removals from forest degradation events subsequent to the first occurrence of degradation;

(iv)   Using the actual values of pre-disturbance forest biomass carbon stocks rather than those for primary forests in estimating EFs for gardening;

(e)   Using information on national circumstances and the drivers of deforestation and forest degradation presented to support the selection of the model used to construct the FRL with a view to demonstrating its consistency with Papua New Guinea's national circumstances in future FRL and results submissions;

(f)   Exploring the use of a more robust methodology to identify savannah and scrub areas meeting the forest definition;

(g)   Considering the treatment of emissions from deadwood;

(h)   Including emissions from soil organic carbon;

(i)   Monitoring non-CO_2 gases from biomass burning and considering their potential inclusion, if considered significant;

(j)   Broadening the scope of the FRL and the reporting of results by assessing the significance and potential inclusion of any other potentially significant activities excluded owing to lack of data, in line with the national GHG inventory;

(k)   Improving the methods for estimating emissions and removals from the activity enhancement of forest carbon stocks.

37.   During the TA of the reported results, a few additional areas for future technical improvement were identified:

(a)   Developing clearer guidelines for operators working to determine whether observed forest change events are anthropogenic or non-anthropogenic;

(b)   Further developing the methods for uncertainty assessment;

(c)   Applying the post-deforestation removal correction to the reference period of a future FRL (which is already being done for the results period) to improve consistency between the methodologies used to establish the results and those used to construct the FRL;

(d)   Improving consistency with the forest definition by assigning a threshold of 10 per cent to forest land when using a hierarchical rule to determine the predominant land use for areas of interest in instances where there are combinations of two or more classes.

D.   Comments and responses of the Party

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

(a)   Improved collection of AD related to the activity enhancement of forest carbon stocks;

(b)   Further development of quality assurance and quality control procedures in relation to the estimation of AD and EFs for REDD+ MRV;

(c)   Improved uncertainty assessment in relation to the estimation of AD and EFs, and a combination of different sources of uncertainty;

(d)   General improvement of REDD+ reporting (e.g. by further developing tier 2 and 3 methodologies, further enhancing transparency in reporting, and improving data management systems and institutional arrangements);

(e)   Development of a REDD+ results reporting manual that summarizes various reporting requirements (IPCC, UNFCCC, etc.) in order to produce standardized REDD+ reports in the future.

III.   Conclusions

39.   The LULUCF experts conclude that Papua New Guinea reported the results of the implementation of the activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks for 2014–2015. The report covers Papua New Guinea's national territory and includes estimates of CO_2 emissions from the carbon pools above-ground biomass and below-ground biomass. The results of the activities were reported using methodologies, definitions, assumptions and information that were overall consistent with those used for the assessed FRL.

40.   The LULUCF experts consider the data and information provided in the technical annex to be overall transparent, consistent, complete and accurate to the extent possible.

41.   The LULUCF experts found that the data and information provided in the technical annex are consistent with the guidelines referred to in decision 14/CP.19, paragraph 11.

42.   The results are overall accurate to the extent possible, based on the assumptions used. The LULUCF experts noted that Papua New Guinea is taking steps to improve future estimates of results by using information from its ongoing NFI and collecting improved data on the enhancement of forest carbon stocks.

43.   In conclusion, the LULUCF experts commend Papua New Guinea for showing a strong commitment to the continuous improvement of the data and information used for calculating the results, in line with the stepwise approach, which are overall consistent with those used to establish its assessed FRL. Some areas for future technical improvement and capacity-building needs identified by Papua New Guinea 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.[9] The LULUCF experts also acknowledge that the TA process was an opportunity for a facilitative and constructive technical exchange of views and information with Papua New Guinea.[10]

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[9] In accordance with decision 2/CP.17, para. 57.

[10] In accordance with decision 14/CP.19, paras. 12 and 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 is not reproduced here. It is available on the UNFCCC website at https://unfccc.int/BURs.

Annex II

Summary of the main features of the proposed results of the implementation of the activities referred to in decision 1/CP.16, paragraph 70, based on information provided by Papua New Guinea

	Key elements	*Remarks*
Results reported	3 957 412 t CO_2 eq (2014) 5 045 902 t CO_2 eq (2015)	See paragraph 9 of this document
Results period	2014–2015	See paragraph 9 of this document
Assessed FRL	43 369 737 t CO_2 eq (2014) 45 049 344 t CO_2 eq (2015) 46 728 951 t CO_2 eq (2016) 48 408 557 t CO_2 eq (2017) 50 088 164 t CO_2 eq (2018)	The modified FRL submission (July 2017) and accompanying technical assessment report are available on the REDD+ web platform[a] (see para. 8 of this document)
Reference period	2001–2013	See paragraph 9 of this document
National/subnational	National	See paragraph 14 of this document
Activities included	Reducing emissions from deforestation Reducing emissions from forest degradation Enhancement of forest carbon stocks	The activity enhancement of forest carbon stocks is included but reported as accounting for zero removals during the historical reference period and the results period (see para. 30 of this document)
Pools included	Above-ground biomass Below-ground biomass	See paragraph 14 of this document
Gas included	CO_2	See paragraph 14 of this document
Consistency between assessed FRL and the results	Methods, definitions and information used for the assessed FRL are overall consistent with the results	The described methods, definitions and information used for reporting the assessed FRL and results are overall consistent. However, a post-deforestation removal correction factor was only applied for the results period and not for the reference period (see para. 15 of this document)
Description of NFMS and institutional roles	Included	See paragraph 26 of this document
Identification of future technical improvements	Included	Several areas for future technical improvement were identified (see paras. 36 and 37 of this document)

[a]   https://redd.unfccc.int/submissions.html?country=png.

Annex III

Documents and information used during the technical analysis

Reference documents

First and modified FRL submissions of Papua New Guinea. Available at https://redd.unfccc.int/submissions.html?country=png.

First BUR of Papua New Guinea submitted in 2019. Available at https://unfccc.int/BURs.

Fox JC, Yosi CK, Nimiago P, et al. 2010. Assessment of aboveground carbon in primary and selectively harvested tropical forest in Papua New Guinea. *Biotropica*. 42(4): pp.410–419.

"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/resource/docs/2013/cop19/eng/10a01.pdf#page=36.

"Guidelines for submissions of information on reference levels". Annex to decision 12/CP.17. Available at https://unfccc.int/resource/docs/2011/cop17/eng/09a02.pdf#page=19.

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.

Report on the TA of the proposed FRL of Papua New Guinea submitted in 2017. FCCC/TAR/2017/PNG. Available at https://redd.unfccc.int/submissions.html?country=png.