United Nations

FCCC/TAR/2022/PAN

Framework Convention on Climate Change

Distr.: General
25 August 2022

English only

Report on the technical assessment of the proposed forest reference level of Panama submitted in 2022

Summary

This report covers the technical assessment of the voluntary submission of Panama 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 Panama 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 activities included in decision 1/CP.16, paragraph 70.

For its submission, Panama developed a national FRL for its entire territory. The FRL presented in the original and modified submissions, for the reference period 2006–2015, corresponds to –20,433,129.66 tonnes of carbon dioxide equivalent per year.

The assessment team notes that the data and information used by Panama in constructing its FRL are generally transparent, complete and in overall accordance with the guidelines contained in decision 12/CP.17, annex. 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 decision 13/CP.19, annex.

Please recycle

Abbreviations and acronyms

2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*
AD	activity data
AT	assessment team
BUR	biennial update report
CH_4	methane
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
COP	Conference of the Parties
EF	emission factor
FRL	forest reference level
GHG	greenhouse gas
IPCC	Intergovernmental Panel on Climate Change
LULUCF	land use, land-use change and forestry
N_2O	nitrous oxide
NC	national communication
NFI	national forest inventory
REDD+	reducing emissions from deforestation; reducing emissions from forest degradation; conservation of forest carbon stocks; sustainable management of forests; and enhancement of forest carbon stocks (decision 1/CP.16, para. 70)
SOC	soil organic carbon
TA	technical assessment

I. Introduction and summary

A. Overview

1. This report covers the TA of the voluntary submission of Panama on its proposed FRL,[1] submitted on 3 January 2022, in accordance with decisions 12/CP.17 and 13/CP.19. The TA took place from 21 to 25 March 2022 and was coordinated by the secretariat.[2] The TA was conducted by two LULUCF experts from the UNFCCC roster of experts[3] (hereinafter referred to as the AT): Thomas Brandeis (United States of America) and Walter Oyhantçabal (Uruguay). In addition, Fazle Rabbi Sadeque Ahmed, an expert from the Consultative Group of Experts, participated as an observer[4] during the session. The TA was coordinated by Pierre Brender (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, Panama submitted its proposed FRL on a voluntary basis. The proposed FRL is one of the elements[5] to be developed in 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. Panama provided its submission in Spanish. The submission is supported by 20 annexes (in Spanish), covering legislative and legal frameworks (annexes 1–5), the NFI methodology and estimation of AD and EFs (annexes 6–15), and stratification, estimation and usage protocols and processes for the Collect Earth tool (annexes 16–20), which enhance the completeness of the FRL. These annexes were shared with the AT but have not been made public.

4. The objective of the TA is to assess the degree to which the information provided by Panama is in accordance with the guidelines for submissions of information on reference levels[6] and to offer a facilitative, non-intrusive, technical exchange of information on the construction of the FRL with a view to supporting the capacity of Panama to construct and improve its FRL in the future, as appropriate.[7]

5. The TA of the FRL submitted by Panama was undertaken in accordance with the guidelines and procedures for the TA of submissions from Parties on proposed forest reference emission levels and/or FRLs.[8] This report on the TA was prepared by the AT following the same guidelines and procedures.

6. Following the process set out in those guidelines and procedures, a draft version of this report was communicated to the Government of Panama. The facilitative exchange during the TA allowed Panama to provide clarifications and additional information, which were considered by the AT in the preparation of this report.[9] As a result of the facilitative interactions with the AT during the TA, Panama provided a modified version of its submission on 11 May 2022, 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.

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

B. Proposed forest reference level

7. In decision 1/CP.16, paragraph 70, the COP encouraged developing country Parties to contribute to mitigation actions in the forest sector by undertaking a number of activities, as deemed appropriate by each Party and in accordance with their respective capabilities and national circumstances, in the context of providing adequate and predictable support. The FRL proposed by Panama, 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, Panama developed a national FRL that covers its entire territory. For its submission, Panama 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 FRL by incorporating better data, improved methodologies and, where appropriate, additional pools.

8. The national FRL proposed by Panama for the historical reference period 2006–2015[10] is the annual average of the net CO_2 eq emissions and removals associated with the five REDD+ activities (with emissions and removals for the activities "conservation of forest carbon stocks" and "sustainable management of forests" reported on an aggregate basis). The AD used in constructing the FRL were extracted from a historical time series of land-use maps developed by the Ministry of Environment for 1990, 2000 and 2008. The EFs were tier 2 EFs derived from Panama's NFI (covering 2013–2018) and default tier 1 EFs from the 2006 IPCC Guidelines. The FRL presented, with the aim of accessing results-based payments for REDD+ activities for 2006–2015, corresponds to –20,433,129.66 t CO_2 eq/year.[11]

9. The proposed FRL includes the pools above-ground biomass, below-ground biomass, deadwood and litter. SOC and harvested wood products are not included. Regarding GHGs, the submission includes CO_2, CH_4 and N_2O.

10. The FRL proposed by Panama is its second FRL submitted in the context of applying the stepwise approach in accordance with decision 12/CP.17, paragraph 10. Its previous national FRL was submitted on 15 January 2018 and was subject to a TA in March 2018;[12] it covered the activities "reducing emissions from deforestation", "reducing emissions from forest degradation", "conservation of forest carbon stocks", "sustainable management of forests" and "enhancement of forest carbon stocks" for 2006–2015, and the modified submission covered 2000–2015. The previous assessed FRL corresponded to –27,735,675 t CO_2 eq/year and was therefore lower than the FRL proposed in the most recent submission. The assessed FRL proposed in the modified 2018 submission differs from that in the most recent submission owing mainly to changes in the methods used to produce the AD, the reference period used and the use of new tier 2 EFs from the 2013–2018 NFI.

11. For reasons of clarity and completeness, Panama provided information on legal aspects in the annexes to its submission, which was not subject to the TA.

[10] 10 years of AD, the first and last years corresponding to changes in land use observed between 2005 and 2006 and between 2014 and 2015, respectively. For other AD, such as fires and annual wood removals, the Party used AD by calendar year.

[11] This figure remained the same in both the original and the modified submissions.

[12] See document FCCC/TAR/2018/PAN.

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

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

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

12. For constructing its FRL, Panama used the 2006 IPCC Guidelines. AD were collected by analysing remote-sensing data sets available through Collect Earth Online. The EFs are a combination of tier 2 EFs derived on the basis of NFI data and default tier 1 EFs from the 2006 IPCC Guidelines. The main methodology for estimating carbon stock changes is the gain–loss method from the 2006 IPCC Guidelines. In the submission, the Party provided detailed descriptions of the IPCC methods used to calculate gains and losses, the sources of the AD and the parameters and EFs used. The AT considers that the submission is transparent in this regard.

13. The FRL 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", and the selected reference period is 2006–2015. Under "enhancement of forest carbon stocks", Panama included afforestation and the increase in carbon stocks in forests from conversion of *rastrojos* to secondary forests, but noted that it could not estimate the area of secondary forests converted to mature forests. The AT also noted that the estimates for the FRL include total emissions and removals from land conversions to forest land, forest land conversions to other land uses and forest land remaining forest land, and correspond to the aggregated emissions and removals resulting from the five REDD+ activities.

14. The FRL includes all land-use categories and subcategories, covering natural forest and plantations, and covers CO_2 emissions and removals from carbon stock changes and CH_4 and N_2O emissions from fires. All carbon pools except SOC and harvested wood products are included.

15. EFs were derived on the basis of data from the Party's NFI, which used a systematic stratified sampling grid across the entire national territory except for insular zones. Maps of land cover and use in 2012 and 2017 and of forest and other land with tree cover in 2019 were used to develop the sampling strata and calculate the related expansion factors. Data were collected on trees, woody understory vegetation, deadwood, stumps, land use, land cover and other variables. Above-ground live tree biomass was estimated using the allometric equations in Chave et al. (2014) and the carbon fraction for tree species obtained from Martin and Thomas (2011), with default values from the 2006 IPCC Guidelines used for cases where values specific to a given land-use change or forest type were not available. Additional allometric equations obtained from scientific literature were used for palm, tree fern and liana biomass. Below-ground biomass was estimated using the models in Cairns et al. (1997) for tropical forests. Other default factors by climatic region, taken from the 2006 IPCC Guidelines, were also used, for instance, ratios of below-ground to above-ground biomass and biomass increments for some forest types.

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

16. The AT notes the Party's efforts to improve the quality of the AD and the EFs compared with its first FRL submission.

17. In section 7.1.1.2 of its original FRL submission, the Party explained that NFI sampling points were spread evenly across the national territory. However, the AT noted in figure 3, which presents the actual locations of the NFI sampling points, that they did not appear to be evenly distributed, with large areas of mapped forest missing a sampling point.

In response to a question from the AT during the TA, Panama confirmed that, where locations were inaccessible or hazardous, it replaced the corresponding sampling points for these locations with other points in accessible or safe areas. The AT is of the view that this procedure may result in bias in the sampling against characteristics that may be more prevalent in difficult-to-access locations, such as less degradation. To improve the transparency of its reporting, Panama included in its modified submission a paragraph within section 7.1.2 to explain how it replaced sampling points in the Darién Gap area, which was excluded from sampling owing to its inaccessibility, and in other areas where sampling may have endangered the life of the sampling team owing to insecurity, opposition from indigenous peoples and access difficulties. The AT commends Panama for increasing the transparency of its reporting and notes reviewing the sampling method to avoid any bias that may be introduced by the current approach as an area for future technical improvement.

18. The AT also sought clarifications on the source of the total land area of Panama specified in the FRL. The AT noted that the original submission contained different figures for this area, which may affect the accuracy of the FRL. Panama clarified this topic during the TA and clearly explained in the modified submission that it used the latest estimate available when preparing the FRL.

19. The AT found that the differences in AD and EFs between the most recent FRL submission on the one hand and the previous FRL submission and second BUR (2021) on the other were not fully explained in the original submission. Therefore, the AT asked Panama to provide further clarifications and describe in greater detail how it has improved its reporting compared with earlier reports. Panama provided further information in its modified submission, specifically on how strata were defined and sampling points were categorized in Collect Earth Online for the estimation of AD, and on how EFs were calculated from the NFI.

20. The AT found that the Party could increase the transparency of the original submission by providing a clearer explanation of how the areas adjacent to but outside the area of the Collect Earth Online sampling points were taken into account when applying the minimum area criteria of the national definition of forest. In response to a question from the AT and in its modified submission, Panama provided the clarifications summarized in paragraph 27(b) below.

21. The AT found that the inclusion of *rastrojos* in the land category forest was not sufficiently justified in the original submission. In response to a question from the AT, Panama explained that *rastrojos* are shrubland areas that have been declared for forest use and are classified as forest because, in the future, the woody plants they contain are expected to meet the 5 m forest definition threshold. Panama also included areas of *rastrojos* with abiotic conditions that prevent woody vegetation from reaching 5 m in height in situ but with canopy cover of at least 30 per cent. Panama included these clarifications in its modified submission. However, the AT considers that the reporting of the characteristics that distinguish between shrubland that meets the definition of forest and other shrubland that does not is not fully transparent, and notes that Panama may consider reviewing the assumptions used in this regard, as defining shrubland as forest when it is not (because it is known that the abiotic conditions prevent the forest definition being met) may erroneously increase the actual total forest area of Panama. The AT considers the use of more robust methodologies for detecting areas of shrubland that meet the national definition of forest as an area for future technical improvement.

22. The AT found that the original submission does not explain how Panama distinguishes between mature and secondary forests with the satellite imagery it uses. The Party clarified the methods it uses for this purpose in its modified submission, namely employing indicators such as the spectral characteristics of pixels, the rugosity of images and the geographical context, given that mature forests are generally found in protected areas or mountainous areas in the country. The AT commends Panama for including these explanations in the modified submission.

23. Panama applied the gain–loss method from the 2006 IPCC Guidelines to estimate carbon stock changes (see para. 12 above). In its submission, Panama included information on the sources of AD used and outlined the limitations of the available statistical information.

Panama further clarified that, as part of the planned improvements for its GHG emission estimates, it intends to update the official tree harvesting permit registration forms and wood mobilization guides with a view to enabling the quantity of harvested wood resulting from these permits to be recorded, thereby increasing the accuracy of the estimates for wood removals. The AT notes that these planned improvements to the statistics on firewood quantities by source and extraction site should improve the accuracy of the Party's estimates of carbon stock losses from firewood extraction and commends Panama for this plan. The AT further notes that wood removals for direct sales to consumers from landowners may need to be estimated by survey, as mentioned in the 2006 IPCC Guidelines (vol. 4, chap. 4, p.4.16), and that any national estimates should be supplemented by regional surveys or local studies on fuelwood consumption since fuelwood is collected from multiple sources, including forests, timber processing residues, farms, homesteads and village commons (2006 IPCC Guidelines, vol. 4, chap. 4, p.4.17). The AT therefore notes carrying out regional surveys or local studies documenting fuelwood extraction in forests and improving documentation of forest concession contracts and tree harvesting permits as areas for future technical improvement.

24. During the TA, Panama clarified that it is in the process of expanding the sample size of its NFI but does not currently plan to resample any plots. The AT considers that subjecting the NFI plots to a new sampling cycle with a view to remeasuring the relevant data and obtaining new data on carbon stock changes related to land use and land-use change is an area for future technical improvement.

25. For the activity "enhancement of forest carbon stocks", for years in which a transition from non-forest land to *rastrojos* or from *rastrojos* to secondary forest is detected, the carbon stock of the land is assumed to instantaneously change from the average carbon stock of the stratum under which the land was classified pre-transition to that of its post-transition stratum classification. In response to a question from the AT, Panama explained that it assumed that the complete stock is available immediately after conversion, since, with regard to visually interpreting conversions of this type, elements associated with the forest type can only be identified after several years have passed. The AT considers that, as noted during the TA of the first FRL of Panama,[13] this practice could lead to an overestimation of removals, especially those associated with the conversion of *rastrojos* to secondary forest, since this transition actually occurs over a number of years. However, with regard to the emission reduction estimates, Panama may be able to partially mitigate these overestimations by applying the same assumption over the result period. Panama also applied equation 2.9 from the 2006 IPCC Guidelines (vol. 4, chap. 2), which would be the relevant equation for estimating removals on an annual basis but used the AD corresponding to the area converted in that particular year to estimate the gains in carbon, instead of using the (much bigger) accumulated area converted over the default 20-year period. These calculations are not in line with the 2006 IPCC Guidelines (vol. 4, chap. 4.3.1.3) and may lead to an overall overestimation of removals, with a significant overestimation of removals in the year the conversion is detected, partially compensated for by an underestimation of removals in the preceding and subsequent years. During the TA, Panama noted that it recognizes that it must improve its inventory before it can determine the amount of carbon stock following a land transition in a particular year. The AT acknowledges that refining this approach may require more complex and laborious calculations, increased capacity and more time and resources. The AT also notes that, as an area for future technical improvement, Panama could revise its assumption in line with the 2006 IPCC Guidelines (vol. 4, chap. 4.3.1.3) to estimate removals from land-use changes contributing to the activity "enhancement of forest carbon".

26. The AT noted significant inter-annual variability in emissions under the different REDD+ activities. To better understand the reasons for this variability, the AT asked Panama to provide socioeconomic information. In response, during the TA, Panama explained that its analysis of the reasons behind the variability revealed some correlation with the unemployment rate, noting that deforestation and forest degradation were also influenced by a combination of factors including rising demand for agricultural products, significant changes to the country's transport infrastructure and land tenure regime, the concentration of land ownership, population growth, the expansion of agricultural production and public

[13] FCCC/TAR/2018/PAN, para. 32

policies. Panama included information on this matter in its modified submission. The AT commends Panama for clarifying this matter.

27. In its most recent FRL submission, Panama described the following changes from its previously submitted FRL in accordance with decision 12/CP.17, annex, paragraph (b):

(a) Changes in the methodology used to generate AD, involving moving from a systematic sampling grid of 13,794 plots with 3 km grid spacing to a stratified random sampling of 9,800 plots using four strata (stable forests, mangroves, areas of land-use change and other land) and post-stratification according to three climate regions. The plot sizes were increased from 0.5 to 1 ha, and the number of observation points per plot was reduced from 49 to 25. The land-use category was recorded at the each of the 25 points within each 1 ha plot under the stratified random sampling protocol; in contrast, under the systematic sampling approach, the 49 points per plot were only used as a guide to assign a single use to the entire 0.5 ha plot;

(b) A change in the approach to collecting AD, moving away from applying hierarchical rules for plots with more than one land use, which involved only assigning one land use to each plot, and instead assigning a land use to each of the 25 observation points within a plot. During the TA, Panama clarified that individual observation points were labelled as forest either because more than half of the points within the 1 ha plot were interpreted as forest or because the points labelled as forest were contained in a 0.5 ha area interpreted as forest, also taking into account areas adjacent to the plot. This observation point level approach also applied to the characterization of land-use change;

(c) A change in the reporting of the land category mature disturbed forests, which was considered a separate stratum for the first submission but was included in the stratum stable forests for the most recent submission;

(d) A change in the time frame of the reference period (from 2000–2015 to 2006–2015);

(e) The use of new EFs, as documented in the Party's 2020 national inventory report, its second BUR and a table provided to the AT during the TA. In its modified submission, Panama clarified that its 2018 FRL was based on the best data available at that time, with EFs derived from 36 plots taken from the pilot phase of the NFI, while the current FRL considered all 87 plots on which the full NFI is based. The EFs are now disaggregated by climatic region (tropical montane, humid tropical and very humid tropical), whereas the 2018 FRL used the humid tropical region only.

28. The AT commends Panama for sharing detailed annexes, spreadsheets and a bibliography with its submission, which enhanced completeness. The AT notes the publication of the annexes and the correction of several broken links within the annexes as areas for future technical improvement that would improve the transparency of the Party's reporting.

29. The Party presented an uncertainty analysis in its FRL submission (p.89), using the error propagation method described in the 2006 IPCC Guidelines (equations 3.1–3.2, vol. 1, chap. 3). The uncertainties were estimated separately for the five REDD+ activities, on the basis of which an overall uncertainty of 12 per cent was estimated.

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

30. In its FRL submission, Panama provided a detailed description of relevant policies and plans, including a description of the institutional arrangements and legal and regulatory framework relevant to REDD+ activities. It also briefly described its national REDD+ strategy and National Forest Restoration Program, the forest-related activities included in its nationally determined contribution and its participation in the Latin American Network on Greenhouse Gas Inventories.

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

31. 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.

32. The pools included in the Party's FRL are above-ground biomass, below-ground biomass, litter and deadwood. SOC and harvested wood products were not included.

33. In its submission, Panama explained that it excluded SOC from its FRL owing to a lack of national data on the potential impacts of changes in land use and management practices on this pool. The AT noted that Panama included a tier 1 estimate of the contribution of soil to emissions/removals (equating to 0.27 per cent of the FRL net removals) as an acceptable indicator of the low significance of this pool, and the AT therefore considered that the exclusion of SOC was adequately justified. In the modified FRL submission, Panama further explained its exclusion of SOC and reported net emissions from SOC for the 2006–2015 time series using the tier 1 approach (p.89). The AT commends Panama for these additions. The AT noted that the Party could consider using the tier 1 method from the 2006 IPCC Guidelines to estimate carbon stock changes and corresponding EFs in the SOC pool until national data are obtained. The AT considers the inclusion of emissions from SOC as an area for future technical improvement, noting that it would also increase consistency with the GHG inventory included in the Party's NC3 and second BUR. In addition, in its improvement plan (p.97 of the modified submission), Panama referred to inorganic carbon and liming. The AT notes that, according to the 2006 IPCC Guidelines (vol. 4, chap. 2, p.2.37), inorganic carbon is only to be included in tier 3 approaches. The AT also notes that, according to the Party's second BUR, liming on agricultural land only accounts for some 1 kt CO_2 eq/year and yet for 46 per cent of Panama's limestone imports. The AT therefore considers that inorganic carbon and liming may not be the highest priority for improving the FRL in the future.

34. The AT acknowledges that Panama included in its FRL all five activities identified in decision 1/CP.16, paragraph 70, in accordance with its national capabilities and circumstances. The AT notes that this makes the FRL similar in substance to the LULUCF section in the GHG inventory included in the Party's NC3 and second BUR, meaning that the figures in the FRL (in t CO_2 eq) should be consistent with those in the inventory, noting that some pools or gases included in the inventory were not included in the FRL. However, there were some inconsistencies in this regard. Panama explained in section 2.3 of its modified submission that these were caused by steps taken to improve its estimation of AD for the estimation of the FRL, especially the use of stratification.

4. Definition of forest

35. Panama provided in its submission the definition of forest used in constructing its FRL. The definition is based on three thresholds: a minimum area of 0.5 ha, a minimum height of 5 m and a minimum canopy cover of 30 per cent. These thresholds also apply to trees capable of reaching them in situ, provided that the land has been declared for forest use (restoration, conservation and/or management). Therefore, the forest area also includes the *rastrojos* category for shrubland that has been declared for forest use and does not yet fully meet the definition of forest but is expected to do so in the future. In response to a question from the AT, the Party clarified that the term *rastrojos* is used in some other Spanish-speaking countries to refer to non-forest vegetation, but that this is not the case in Panama. The Party's definition further states that within land declared for forest use, where abiotic conditions prevent trees from reaching 5 m in situ, a canopy cover of 30 per cent is sufficient to be considered forest. Land subject to predominantly agricultural or urban use is excluded irrespective of its canopy cover. This definition is the same as that used by the Party for its reporting to the Food and Agriculture Organization of the United Nations for the Global Forest Resources Assessment. Panama did not specify its definition of forest in its NC3 or second BUR but stated in section 2.3 of its FRL submission that the definition of forest remained the same across the three reports.

III. Conclusions

36. The information used by Panama in constructing its FRL for 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" is generally transparent and complete and in overall accordance with the guidelines for submissions of information on reference levels.

37. The FRL presented in the submission is Panama's second FRL. The previous FRL was originally submitted on 15 January 2018, then modified and resubmitted on 6 July 2018, and subject to a TA in 2019; it covered the activities "reducing emissions from deforestation", "reducing emissions from forest degradation", "conservation of forest carbon stocks", "sustainable management of forests" and "enhancement of forest carbon stocks" for 2000–2015.

38. The FRL presented in the most recent modified submission, for the reference period 2006–2015, corresponds to –20,433,129.66 t CO_2 eq/year.

39. The AT acknowledges that Panama included in its FRL all five REDD+ activities, the most important forest types and the most significant pools in terms of emissions from forests. The AT considers that, in doing so, Panama followed decision 1/CP.16, paragraph 70, on activities undertaken, and decision 12/CP.17, paragraph 10, on applying the stepwise approach.

40. As a result of the facilitative interactions with the AT during the TA, Panama 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 Panama on its efforts. The new information provided in the modified submission, including the annexes shared with the AT during the TA and the examples of how estimates of CO_2 emissions from deforestation were calculated, increased the reproducibility of the FRL calculations.

41. The AT notes that, overall, Panama did not maintain consistency, in terms of sources of AD and EFs used for its FRL, with those used for the GHG inventory included in its NC3 (2018) and second BUR (2021).[14]

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

(a) Reviewing the sampling method to avoid any bias that may be introduced by the current approach, in which sampling points for locations that are inaccessible or hazardous are replaced with other points in accessible or safe areas (see para. 17 above);

(b) Using more robust methodologies to detect areas of shrubland that meet the national definition of forest (see para. 21 above);

(c) Conducting regional surveys or local studies documenting fuelwood extraction in forests and improving the documentation of forest concession contracts and tree harvesting permits (see para. 23 above);

(d) Subjecting NFI plots to a new sampling cycle with a view to remeasuring the relevant data and obtaining new data on carbon stock changes related to land use and land-use change (see para. 24 above);

(e) Revising its assumption in line with the 2006 IPCC Guidelines (vol. 4, chap. 4.3.1.3) for the estimation of removals from land-use changes contributing to the activity "enhancement of forest carbon stocks" (see para. 25 above);

(f) Publishing the annexes mentioned in the FRL submission and correcting the broken links within the annexes (see para. 28 above).

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

43. 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 Panama are likely to be insignificant in the context of the FRL. Nevertheless, pursuant to decision 13/CP.19, annex, paragraph 3, the AT identified an additional area for future technical improvement regarding pools and gases excluded from the FRL, namely including the SOC pool, using tier 1 estimates until national data are obtained, with a view to improving consistency with the GHG inventory included in the Party's NC3 and second BUR (see para. 33 above).

44. The AT acknowledges and welcomes the Party's intention to improve its FRL in the future by:

(a) Using higher-resolution remote-sensing images and radar data;

(b) Revising some EFs;

(c) Developing estimates of the impact of activities such as liming on soil carbon;

(d) Refining the definition of forest degradation and establishing a threshold to better distinguish between forest degradation and deforestation;

(e) Improving the methodology used to monitor forest fires through remote sensing and improving the wood extraction estimates by including in the agricultural census questions on firewood extraction;

(f) Estimating carbon stock changes in mangroves (including in terms of SOC).

45. In conclusion, the AT commends Panama 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 Panama'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.[15] The AT also acknowledges that the TA was an opportunity for a rich, open, facilitative and constructive technical exchange of information with Panama.

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

[15] 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 Panama

Main features of the FRL		*Remarks*
Proposed FRL	–20 433 129.66 t CO_2 eq/year	The FRL is the annual average of the net CO_2 eq emissions and removals associated with the five REDD+ activities (see para. 8 of this document)
Type and reference period of FRL	FRL = average of historical emissions and removals in 2006–2015	The FRL is the average of historical emissions and removals in the specified period (see para. 27(d) of this document)
Application of adjustment for national circumstances	No	Not applicable
National/subnational	National	Panama developed a national FRL that covers its entire territory (see para. 7 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	Panama included the five REDD+ activities, reporting on the activities "conservation of forest carbon stocks" and "sustainable management of forests" in an aggregated manner (see paras. 8, 13 and 34 of this document)
Pools included	Above-ground biomass Below-ground biomass Deadwood Litter	SOC is not included owing to a lack of national data for estimating changes in this pool (see paras. 32–33 of this document)
Gases included	CO_2, CH_4, N_2O	CO_2 emissions and removals from carbon stock changes and CH_4 and N_2O emissions from fires are estimated (see para. 14 of this document)
Forest definition	Included	Panama defined forest as an area equal to or greater than 0.5 ha, with a minimum height of 5 m and at least 30 per cent canopy cover, or the potential to achieve those thresholds within areas that have been declared for forest use. This definition is consistent with that used by the Party for its reporting to the Food and Agriculture Organization of the United Nations for the Global Forest Resources Assessment, but the Party's NC3 and second BUR do not include a definition of forest, but stated in section 2.3 of its FRL submission that the definition of forest remained the same across the three reports (see para. 35 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 (2021)	The methods used for estimating the FRL are not fully consistent with those used in the latest GHG inventory, as they produce different results for the same years despite Panama using Collect Earth to estimate AD in both cases. In its FRL, Panama attributed these differences to improved application of methods and EFs.

Main features of the FRL		*Remarks*
		Additionally, the SOC pool is included in the second BUR, but not in the FRL, and the BUR does not include information on methods used for estimating changes in pools and sources (see paras. 19 and 33–34 of this document)
Description of relevant policies and plans	Included	The Party described relevant policies and plans (see para. 30 of this document)
Description of assumptions on future changes to domestic policy, if included in constructing the FRL	Not applicable	
Description of changes to previous FRL	Included	The most recent FRL describes changes from the previous FRL, including a different reference period and updated EFs and AD (see para. 27 of this document)
Identification of future technical improvements	Included	Several areas for future technical improvement have been identified (see paras. 42–43 of this document)

Annex II

Reference documents

A. Reports of the Intergovernmental Panel on Climate Change

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

B. UNFCCC documents

First and second FRL submissions of Panama. Available at https://redd.unfccc.int/submissions.html?country=pan.

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

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

NC3 of Panama (in Spanish). Available at https://unfccc.int/non-annex-I-NCs.

Report on the TA of the proposed FRL of Panama submitted in 2018. FCCC/TAR/2018/PAN. Available at https://unfccc.int/sites/default/files/resource/tar2018_PAN.pdf.

Second BUR of Panama (in Spanish). Available at https://unfccc.int/BURs.

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:

Cairns MA, Brown S, Helmer EH et al. 1997. *Root biomass allocation in the world's upland forests.* Oecologia, 111(1): 1–11.

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

Martin AR, Thomas SC 2011 *A Reassessment of Carbon Content in Tropical Trees.* PLoS ONE 6(8): e23533. doi:10.1371/journal.pone.0023533.