



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

Summary

This report covers the technical assessment of the voluntary submission of Guatemala on its proposed forest reference emission level (FREL) in accordance with decision 13/CP.19 and in the context of results-based payments. The FREL proposed by Guatemala covers the activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks, which are among the activities included in decision 1/CP.16, paragraph 70.

For its submission, Guatemala developed a national FREL. The FREL presented in the original submission, for the reference period 2006–2016, corresponds to 15,329,948.74 tonnes of carbon dioxide equivalent per year. As a result of the facilitative process during the technical assessment, the FREL was modified to 13,537,504.96 tonnes of carbon dioxide equivalent per year.

The assessment team notes that the data and information used by Guatemala in constructing its FREL are transparent, complete and in overall accordance with the guidelines contained in decision 12/CP.17, annex. This report contains the assessed FREL and a few areas identified by the assessment team for future technical improvement in accordance with the provisions on the scope of the technical assessment contained in decision 13/CP.19, annex.



Abbreviations and acronyms

AD	activity data
AT	assessment team
CNES	French Space Agency
CO ₂	carbon dioxide
CO ₂ eq	carbon dioxide equivalent
COP	Conference of the Parties
CORINE	Coordination of Information on the Environment (programme)
EF	emission factor
FREL	forest reference emission level
GHG	greenhouse gas
IPCC	Intergovernmental Panel on Climate Change
IPCC good practice guidance for LULUCF	<i>Good Practice Guidance for Land Use, Land-Use Change and Forestry</i>
LULUCF	land use, land-use change and forestry
NFI	national forest inventory
QA/QC	quality assurance/quality control
REDD+	reducing emissions from deforestation; reducing emissions from forest degradation; conservation of forest carbon stocks; sustainable management of forests; and enhancement of forest carbon stocks (decision 1/CP.16, para. 70)
TA	technical assessment

I. Introduction and summary

A. Overview

1. This report covers the TA of the voluntary submission of Guatemala on its proposed FREL,¹ submitted on 10 February 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 experts³ (hereinafter referred to as the AT): Craig Wayson (United States of America) and Brian Zutta (Peru). In addition, Fazle Rabbi Sadeque Ahmed (Bangladesh), an expert from the Consultative Group of Experts, participated as an observer⁴ during the session. The TA was coordinated by Luca Birigazzi (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, Guatemala submitted its proposed FREL on a voluntary basis. The proposed FREL is one of the elements⁵ 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 FREL, as referred to in decision 12/CP.17, paragraph 13, shall be subject to a TA in the context of results-based payments.

3. Guatemala provided its submission in Spanish.

4. The objective of the TA is to assess the degree to which the information provided by Guatemala is in accordance with the guidelines for submissions of information on reference levels⁶ and to offer a facilitative, non-intrusive, technical exchange of information on the construction of the FREL with a view to supporting the capacity of Guatemala to construct and improve its FREL in the future, as appropriate.⁷

5. The TA of the FREL submitted by Guatemala was undertaken in accordance with the guidelines and procedures for the TA of submissions from Parties on proposed FRELs and/or forest reference levels.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 Guatemala. The facilitative exchange during the TA allowed Guatemala 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, Guatemala provided a modified version of its submission on 16 July 2022, which took into consideration the technical input of the AT. The modifications improved the clarity and transparency of the submitted FREL without needing to alter the approach used to construct it. This TA report was prepared in the context of the modified FREL submission.

B. Proposed forest reference emission level

7. In decision 1/CP.16, paragraph 70, the COP encouraged developing country Parties to contribute to mitigation actions in the forest sector by undertaking a number of activities, as deemed appropriate by each Party and in accordance with their respective capabilities and national circumstances, in the context of providing adequate and predictable support. The FREL proposed by Guatemala, on a voluntary basis for a TA in the context of results-based

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

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.

payments, covers the activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks, which are three of the five activities referred to in that paragraph. Pursuant to paragraph 71(b) of the same decision, Guatemala developed a national FREL that covers its entire territory, amounting to 10,888,900 ha, of which about 36.5 per cent (3,972,834.66 ha in 2016) is covered by forests. For its submission, Guatemala applied a stepwise approach to developing its FREL in accordance with decision 12/CP.17, paragraph 10. The stepwise approach enables Parties to improve their FREL or forest reference level by incorporating better data, improved methodologies and, where appropriate, additional pools.

8. The national FREL proposed by Guatemala for the historical reference period 2006–2016 is the annual average of the net CO₂ emissions associated with deforestation, defined as the anthropogenic conversion of natural forest to other land uses; forest degradation, defined as partial forest cover loss resulting in a loss of biomass; and removals from the enhancement of forest carbon stocks, defined as carbon stock gained from forest plantations and restoration of degraded forest areas. The proposed FREL includes emissions associated with deforestation calculated through an assessment of the difference between the carbon stock before and after conversion of forest land to non-forest land. The AD used in constructing the FREL were extracted from a historical time series comparison of satellite images collected between 2006 and 2016 within the Collect Earth tool. The EFs for above-ground and below-ground biomass were derived from the 2017 national carbon strata map. This map was created using data obtained from Guatemala’s NFI, permanent plots, independent forest inventories and forest concessions. The FREL presented in the modified submission, with the aim of accessing results-based payments for REDD+ activities for 2006–2016, corresponds to 13,537,504.96 t CO₂ eq/year.¹⁰

9. The proposed FREL includes the pools above-ground and below-ground biomass. Regarding GHGs, the submission includes CO₂ only.

¹⁰ In its original submission, Guatemala proposed a national FREL of 15,329,948.74 t CO₂ eq/year for 2006–2016.

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

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

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

10. For constructing its FREL, Guatemala used both the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* and the IPCC good practice guidance for LULUCF for estimating net annual CO₂ emissions and removals resulting from deforestation, forest degradation and enhancement of forest carbon stocks during the reference period 2006–2016.

11. In the FREL, deforestation was defined as the anthropogenic conversion of forest land to any other non-forest land use, including cropland, grassland, settlements, wetlands and other land. To facilitate the interpretation of land use and land-use change from satellite images, additional subclasses of land use were used, resulting in a three-tiered classification system following a CORINE land-cover classification scheme adapted to Guatemala. The land-use categories were developed jointly by the main institutional authorities of Guatemala, namely the Ministry of Environment and Natural Resources, the Ministry of Agriculture, Livestock and Food, the National Council for Protected Areas and the National Forest Institute.

12. Forest degradation was defined as partial forest cover loss, where the forest remains forest within the parameters of the applied forest definition and subclass of forest. This may include a 30–70 per cent loss of initial canopy cover. If the overall canopy cover per ha falls below the 30 per cent canopy cover threshold for forest, the activity would be considered deforestation rather than forest degradation. The partial forest cover loss results in the reduction of above-ground and below-ground biomass.

13. Enhancement of forest carbon stocks was defined as the recovery of the carbon stock sink after deforestation and forest degradation. This activity only comprises the establishment of forest plantations of conifers and broadleaf trees in areas previously deforested and the restoration of degraded forest areas where at least 30–70 per cent of the initial forest canopy cover has been recovered after degradation.

14. The AD for historical land use and land-use change for 2006–2016 were obtained from a visual interpretation of land use and land-use change using the Collect Earth sampling tool. The sampling design consisted of a systematic grid of 3.1 km x 3.1 km units with a total of 11,369 plots for the entire country. Each plot was a 1 ha square with 25 evenly distributed points on a 5 x 5 distribution pattern. Each point was separated by 20 m. Each unit was visually interpreted using available remote sensing images for either 2006 or 2016. For 2006, national orthorectified aerial photographs with a very high spatial resolution of 0.5 m were used. Additional images from Google Earth for 2004–2006 were used if there was too much cloud cover. For the entire period from 2006 to 2016, a variety of very high spatial resolution remote sensing images were used, in particular from CNES Airbus, DigitalGlobe, the Mexican National Institute of Statistics and Geography, Copernicus and Google Earth. The visual interpreters of the samples reviewed the available images of all years between 2006 and 2016, with the objective of detecting any changes for reporting within the reference period. If no high resolution images were available owing to cloud cover, moderate spatial resolution Landsat 5, 7 and 8 images (i.e. 30 m pixel size) were used. The Party indicated that images from 2017 were used if no cloud-free images were available for 2016. The visual interpretation was carried out by nine local interpreters from government institutions, non-governmental organizations and academia.

15. The carbon stock estimates used for calculating the EF for above-ground and below-ground biomass were derived from the 2017 national carbon strata map, which covers the entire country. Data from more than 3,000 plots were used, sourced from, inter alia, the first cycle of the NFI, permanent plots, independent forest inventories and forest concessions. The filtering of appropriate forest plots resulted in 2,306 plots being used in the development of the map. The plot data were harmonized by calculating above-ground biomass from trees

with a minimum 10 cm diameter and using allometric equations based on forest type and region. Below-ground biomass was calculated using an equation for the region. Each plot was stratified according to bioclimatic values obtained from the Worldclim database. The resulting information led to a regrouping of the original strata into four different carbon strata with different EF values.

16. The EF for deforestation corresponds to the loss of carbon stock between 2006 and 2016 resulting from conversion of forest land to other non-forest land uses. The EF for forest degradation corresponds to the 50 per cent loss of the initial carbon stock in 2006 resulting from the 30–70 per cent forest cover loss detected in forest land remaining forest land between 2006 and 2016.

17. The absorption factors for enhancement of forest carbon stocks were separated into two groups, namely restoration of degraded forest areas and forest plantations. The recovery of carbon stock in a degraded forest corresponds to the gain in carbon stock from the level of forest degradation in 2006, with a carbon stock value of 50 per cent of a fully stocked forest, to the full recovery of the forest carbon stock in 2016. There is no scaled adjustment in the degree of forest degradation or percentage of canopy cover recovered.

18. The absorption factors for forest plantations correspond to the increase in carbon stock from non-forest to forest plantations of conifers and broadleaf species. Values were developed initially using growth curves of forest plantation species specific to Guatemala obtained from the data and analysis of the National Forest Institute's permanent monitoring plots,¹¹ separated into two groups of tree species (i.e. conifers and broadleaf trees); Monte Carlo simulation to obtain the median annual growth volume; biomass conversion factors; and equation 2.10 from the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* to obtain the final absorption factor.

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

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

19. The AT noted Guatemala's efforts to improve the transparency of the AD used by providing access to online documentation and databases for reconstructing the FREL. The AT also noted issues concerning orthorectification and misalignment of georeferenced images when comparing a number of satellite images from 2006 to 2016 in Collect Earth. This may be due to different sources of satellite images, and subsequent spatial resolution and projections, between images from two different time frames. The extent of the problem this may cause is unknown but it may be an issue when estimating forest degradation, since the loss of canopy tree cover is measured through visual interpretation of the fraction of cover change. The AT commends Guatemala's efforts to improve its QA/QC for future FREL submissions.

20. The AT commends Guatemala's efforts to estimate the propagation of uncertainty using Monte Carlo simulation. The AT noted that the overall uncertainty of the FREL was 76 per cent (the uncertainty for deforestation was 76 per cent, forest degradation 104 per cent, degradation recovery 91 per cent and forest plantation restoration 150 per cent). The AT also noted that Guatemala did not propagate all sources of uncertainty (e.g. all model errors, carbon strata map input values) or implement ideally correlated values in the simulations, and utilized truncated distribution where other forms of distribution might have been more appropriate. The data included in the original FREL submission consisted of 1,000 simulations, instead of the 10,000 simulations recommended in the literature. In the modified submission, the country reran the uncertainty estimations using 10,000 Monte Carlo iterations. The AT notes that the provision of flow charts showing the calculation steps and the equations used would enhance the understanding of the Party's approach to calculating uncertainty. The AT considers the use of the Monte Carlo methodology as an area for future technical improvement of the FREL.

¹¹ See <http://ppm.inab.gob.gt/> (available in Spanish only).

21. The AT noted that Guatemala, overall, maintained consistency, in terms of sources of AD and EFs used for its FREL, with those used for the GHG inventory included in its third national communication, submitted in 2022, as required by decision 12/CP.17, paragraph 8. However, non-CO₂ emissions from forest fires were excluded from the FREL but included in the national communication. During the TA, the Party clarified that the data, methodology and approaches used for making any improvements to the FREL will be consistent and aligned with those used for future GHG inventories. The AT commends Guatemala for its plans to include data on non-CO₂ emissions in future FREL submissions.

22. The AT considers that the information provided by Guatemala during the TA could help to improve the transparency and reproducibility of its future FREL submissions and to help to build confidence in the emission estimates. The AT commends Guatemala for providing the information necessary to reproduce the EFs used for the FREL and the uncertainty analysis (see annex II.C).

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

23. Guatemala described its national REDD+ strategy in the FREL submission (section 2.1). Information was provided on the main objectives of the strategy, which include 29 per cent of the territory covered by natural forest by 2032; 32 per cent of the territory covered by forests that benefit communities economically and environmentally; a 3 per cent increase in forest cover through ecological restoration of land that has capacity for conservation of forests by 2032; potential emission reductions of 12,000,000 t CO₂ eq by 2025; and potential emission reductions of 238,605,164 t CO₂ eq by 2050. In addition, the Party presented brief information on REDD+ projects, mechanisms for compensation for forest ecosystem services, and national incentives for the establishment, restoration, management and protection of forests, as well as forestry investment.

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

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

25. The pools included in the Party's FREL are above-ground and below-ground biomass. Deadwood, litter and soil organic carbon were not included.

26. With regard to emissions from deadwood, litter and soil organic carbon, the AT requested clarification of the reasons for omitting the pools. In response, Guatemala explained that the pools were not included because of lack of national data for providing accurate estimates of those pools. In a rapid assessment using values for deadwood and soil organic carbon, the Party estimated a minor contribution to overall emissions from deforestation and forest degradation (i.e. less than 12 per cent) from these pools. Nonetheless, the Party indicated that efforts are being made to develop national data on these pools. The AT considers that the exclusion of the deadwood, litter and soil organic carbon pools was adequately justified by Guatemala and commends the Party's efforts to obtain better information with the objective of including the pools in future FREL submissions. The AT concludes that emissions from the deadwood, litter and soil organic carbon pools are likely to be insignificant and their exclusion is therefore justified. Nonetheless, the AT notes that the IPCC good practice guidance for LULUCF provides a method for estimating carbon stock change in these pools and can help Guatemala to understand the full scope of changes in pools during land-use conversion. The AT considers the treatment of emissions from deadwood, litter and soil organic carbon as an area for future technical improvement of the FREL.

27. The AT considers the treatment of non-CO₂ gases (i.e. methane and nitrous oxide) as an area for future technical improvement so as to maintain consistency with the GHG inventory included in the Party's 2022 national communication. Forest fires are a significant source of GHG emissions according to the national communication and may occur during both deforestation and forest degradation events.

28. The AT acknowledges that Guatemala included in its FREL the most significant of the five activities identified in decision 1/CP.16, paragraph 70, in accordance with its national

capabilities and circumstances, namely reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks. According to Guatemala, the activities sustainable management of forests and conservation of forest carbon stocks were not included owing to lack of data; however, it noted that efforts as part of its national REDD+ strategy are under way with a view to including these activities in future FRELs when possible.

29. Overall, the AT commends Guatemala for providing information on above-ground and below-ground biomass. The AT acknowledges the Party's intention to improve its FREL in the future once new and adequate data and better information become available as part of the stepwise approach.

4. Definition of forest

30. Guatemala provided in its submission the definition of forest used in constructing its FREL. The definition is the same as that used by the Party for its national GHG inventory (i.e. minimum area of 0.5 ha, minimum height of 5 m, at least 30 per cent canopy cover, minimum width of 60 m and trees with a minimum diameter of 10 cm). However, this definition is slightly different from that used by the Party for its reporting to the Food and Agriculture Organization of the United Nations for the Global Forest Resources Assessment, where the minimum canopy cover is 10 per cent rather than 30 per cent.

III. Conclusions

31. The information used by Guatemala in constructing its FREL for reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks is transparent and complete and in overall accordance with the guidelines for submissions of information on reference levels.

32. The FREL presented in the modified submission, for the reference period 2006–2016, corresponds to 13,537,504.96 t CO₂ eq/year.

33. The AT acknowledges that Guatemala included in its FREL the most significant activities and the most significant pools in terms of emissions from forests. The AT considers that, in doing so, Guatemala followed decision 1/CP.16, paragraph 70, on activities undertaken, and decision 12/CP.17, paragraph 10, on applying the stepwise approach. The AT commends Guatemala for providing information on its ongoing work to develop a FREL for other activities as a step towards constructing a national FREL that includes all five activities.

34. As a result of the facilitative interactions with the AT during the TA, Guatemala 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 FREL submission, without having to alter the approach or values used to construct the FREL, and commends Guatemala on its efforts. The new information provided in the modified submission, including the data made available online¹² and the examples of how estimates of CO₂ emissions from deforestation were calculated, increased the reproducibility of the FREL calculations.

35. The AT notes that, overall, Guatemala maintained consistency, in terms of sources of AD and EFs used for its FREL, with those used for the GHG inventory included in its third national communication.¹³ However, inconsistencies were found with regard to non-CO₂ emissions from forest fires, which were excluded from the FREL but included in the national communication (see paras. 21 and 27 above).

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

¹² <http://snicc.marn.gob.gt/MRV/SNMF>.

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

(a) Improving use of Collect Earth, in particular increasing awareness of and finding practical solutions to orthorectification and alignment issues between time 1 and time 2 satellite images from different sources and of different spatial resolutions;

(b) Using updated NFI values for estimating emissions and removals;

(c) Including carbon stocks of non-forest land converted to forest land (e.g. secondary forests) in future FREL submissions so as to improve the accuracy of the estimates of GHG removals from all carbon pools;

(d) Revising the methodology used for uncertainty calculations to include all sources of uncertainty and more accurately represent uncertainties in the Party's carbon strata map.

37. Pursuant to decision 13/CP.19, annex, paragraph 2(f), in assessing the pools and gases included in the FREL the AT noted that the pools and gases excluded by Guatemala are likely to be insignificant in the context of the FREL. 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 FREL:

(a) Using IPCC default values for emissions from deadwood, litter and soil organic carbon until values for these carbon pools have been developed from the NFI;

(b) Including non-CO₂ gases, particularly emissions from forest fires, in the FREL so as to maintain consistency with the Party's GHG inventory.

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

(a) Further refine the AD used and QA/QC to improve the estimation of land use and land-use change for future FRELS;

(b) Update the EFs of deforestation and forest degradation with new values from the NFI once the latest round of data collection has been completed;

(c) Update the removal factors of forest plantations and degradation recovery with the new time-series data and plots from the National Forest Institute permanent plots for forest measurement and the NFI;

(d) Include all carbon pools, including deadwood, litter and soil organic carbon, using data collected from the updated NFI, in future FRELS.

39. In conclusion, the AT commends Guatemala for showing strong commitment to continuously improving its FREL estimates in line with the stepwise approach. A number of areas for the future technical improvement of Guatemala's FREL have been identified in this report. At the same time, the AT acknowledges that such improvements are subject to national capabilities and policies, and notes the importance of providing adequate and predictable support.¹⁴ The AT also acknowledges that the TA was an opportunity for a rich, open, facilitative and constructive technical exchange of information with Guatemala.

40. The table contained in annex I summarizes the main features of Guatemala's proposed FREL.

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 emission level based on information provided by Guatemala

	<i>Main features of the FREL</i>	<i>Remarks</i>
Proposed FREL	12 167 776.36 t CO ₂ eq/year (emissions from deforestation) 4 243 453.53 t CO ₂ eq/year (emissions from forest degradation) –2 873 724.92 t CO ₂ eq/year (enhancement of forest carbon stocks)	Guatemala submitted its proposed FREL in February 2022. As a result of the facilitative technical exchange of information and clarification during the TA, Guatemala submitted a modified FREL in July 2022 (see paras. 6 and 8 of this document)
Type and reference period of FREL	FREL = average of historical emissions and removals in 2006–2016	The FREL is the annual average of the net CO ₂ emissions associated with deforestation, forest degradation and enhancement of forest carbon stocks. The AD used in constructing the FREL were extracted from a historical time series comparison of satellite images within the Collect Earth tool 2006 and 2016 (see para. 8 of this document)
Application of adjustment for national circumstances	No	
National/subnational	National	See paragraphs 7–8 of this document
Activities included	Reducing emissions from deforestation Reducing emissions from forest degradation Enhancement of forest carbon stocks	The FREL includes emissions associated with deforestation, defined as the anthropogenic conversion of natural forest to other land uses, forest degradation, defined as partial forest cover loss resulting in a loss of biomass, and enhancement of forest carbon stocks, defined as carbon stock gained from forest plantations and restoration of degraded forest areas (see para. 8 of this document)
Pools included	Above-ground biomass Below-ground biomass	Deadwood, litter and soil organic carbon were excluded. The Party stated that national data were not available and tier 1 EFs were considered not appropriate for Guatemala. Furthermore, these pools were considered insignificant (see paras. 25–26 of this document)
Gas included	CO ₂	Non-CO ₂ gases were excluded (see paras. 9 and 27 of this document)
Forest definition	Included	The forest definition used by Guatemala for its FREL (minimum area 0.5 ha, minimum height 5 m, at least 30 per cent canopy cover, minimum width 60 m and trees with minimum diameter of 10 cm) is slightly different from that used for reporting to the Food and Agriculture Organization of the United Nations, in which the canopy cover threshold is 10 per cent (see para. 30 of this document)
Consistency with latest GHG inventory	Methods used for estimating the FREL are consistent with	Although non-CO ₂ emissions from forest fires were estimated for the latest national GHG

<i>Main features of the FREL</i>		<i>Remarks</i>
	those used for the latest GHG inventory (2022)	inventory, they were not included in the FREL (see paras. 21, 27 and 35 of this document)
Description of relevant policies and plans	Included	The Party described its national REDD+ strategy (see para. 23 of this document)
Description of assumptions on future changes to domestic policy, if included in constructing the FREL	Not applicable	
Description of changes to previous FREL	Not applicable	
Identification of future technical improvements	Included	Several areas for future technical improvement have been identified (see paras. 36–37 of this document)

Annex II

Reference documents

A. Reports of the Intergovernmental Panel on Climate Change

IPCC. 2003. *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. J Penman, M Gytarsky, T Hiraishi, et al. (eds.). Hayama, Japan: Institute for Global Environmental Strategies. Available at <http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.html>.

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 modified FREL submissions of Guatemala. Available at <https://redd.unfccc.int/submissions.html?country=GTM>.

“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>.

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:

GIMBUT. 2019. *Protocolo metodológico para el uso de la plataforma Collect, Collect Earth, aplicado para la actualización de niveles de referencia de emisiones forestales de gases de efecto invernadero (GEI) de Guatemala 2006-2016*. Guatemala: Grupo interinstitucional de monitoreo de bosques y uso de la tierra. Available at http://www.snicc.marn.gob.gt/Content/PDF/Protocolo_Metodol%C3%B3gico_COLLECT_EARTH_vf_junio2019.pdf.

Excel spreadsheets used to calculate the FREL

Excel workbook containing an analysis of the orthorectification and alignment issues when comparing a few satellite images from 2006 to 2016

Excel workbook containing the analysis of the samples related to the stratified carbon map.

Excel workbook used to estimate AD

Excel workbook used to estimate the propagation of uncertainty using Monte Carlo simulation

Web page of the Sistema de Información Forestal de Guatemala, containing links to NFI field forms and measurement protocols. Available at <https://www.sifgua.org.gt/SIFGUAData/PaginasEstadisticas/Recursos-forestales/inventario-forestal.aspx>.