United Nations

FCCC/TAR/2020/HND

Framework Convention on
Climate Change

Distr.: General
5 May 2021

English only

Report on the technical assessment of the proposed forest reference level of Honduras submitted in 2020

Summary

This report covers the technical assessment of the voluntary submission of Honduras 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 Honduras covers the activities reducing emissions from deforestation, reducing emissions from forest degradation, conservation of forest carbon stocks, sustainable management of forests and enhancement of forest carbon stocks, which are the five activities included in decision 1/CP.16, paragraph 70. For its submission, Honduras developed a national FRL. The FRL presented in the original and modified submissions, for the reference period 2000–2016 for reducing emissions from deforestation and 2000–2018 for the other activities, corresponds to 8,142,121.66 tonnes of carbon dioxide per year. The assessment team notes that the data and information used by Honduras in constructing its FRL are partially transparent and complete and therefore not fully in accordance with the guidelines contained in the annex to decision 12/CP.17. This report contains the assessed FRL and a few areas identified by the assessment team for future technical improvement in accordance with the provisions on the scope of the technical assessment contained in the annex to decision 13/CP.19.

Please recycle

Abbreviations and acronyms

AD	activity data
AT	assessment team
BUR	biennial update report
C	carbon
CART	Classification and Regression Tree
COP	Conference of the Parties
CO_2	carbon dioxide
EF	emission factor
FAO	Food and Agriculture Organization of the United Nations
FREL	forest reference emission level
FRL	forest reference level
GHG	greenhouse gas
IPCC	Intergovernmental Panel on Climate Change
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)
TA	technical assessment
2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*

I. Introduction and summary

A. Overview

1.   This report covers the TA of the voluntary submission of Honduras on its proposed FRL,[1] submitted on 6 January 2020, in accordance with decisions 12/CP.17 and 13/CP.19. The remote TA[2] took place from 15 to 19 June 2020 and was coordinated by the secretariat.[3] The TA was conducted by two land use, land-use change and forestry experts from the UNFCCC roster of experts[4] (hereinafter referred to as the AT): Andres B. Espejo Minan (Spain) and Carmen Lourdes Meneses Tovar (Mexico). Although an expert from the Consultative Group of Experts was invited to participate during the remote session as an observer,[5] no representative was able to attend. The TA was coordinated by Jenny Wong (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, Honduras submitted its proposed FRL on a voluntary basis. The proposed FRL is one of the elements[6] 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.   Honduras provided its submission in Spanish. The submission was supported by 15 annexes[7] (listed in annex II to this report), also in Spanish, providing additional information that enhanced the transparency of the submission.

4.   The objective of the TA is to assess the degree to which the information provided by Honduras is in accordance with the guidelines for submissions of information on reference levels[8] 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 Honduras for the construction and future improvement of its FRL, as appropriate.[9]

5.   The TA of the FRL submitted by Honduras was undertaken in accordance with the guidelines and procedures for the TA of submissions from Parties on proposed FRELs and/or FRLs.[10] 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 Honduras. The facilitative exchange during the TA allowed Honduras to provide clarifications and additional information, which were considered by the AT in the preparation of this report.[11] As a result of the facilitative interactions with the AT during the TA, Honduras provided a modified version of its submission on 10 September 2020, 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

---

[1] The submission of Honduras is available at https://redd.unfccc.int/submissions.html?country=hnd.

[2] Owing to the circumstances related to the coronavirus disease 2019, the TAs of the FREL and FRL submissions of developing country Parties in 2020 had to be conducted remotely.

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

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

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

[6] See decision 1/CP.16, para. 71(b).

[7] Available at https://sigmof.icf.gob.hn/?page_id=4661; annexes 11–15 were added for the modified submission.

[8] Decision 12/CP.17, annex.

[9] Decision 13/CP.19, annex, para. 1(a–b).

[10] Decision 13/CP.19, annex.

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

of the modified FRL submission. The modified submission, containing the assessed FRL, and the original submission are available on the UNFCCC website.[12]

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 Honduras, 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, Honduras developed a national FRL that covers its entire territory. For its submission, Honduras applied a stepwise approach to developing its FRL in accordance with decision 12/CP.17, paragraph 10. The stepwise approach enables Parties to improve their FRELs or FRLs by incorporating better data, improved methodologies and, where appropriate, additional pools.

8.   The national FRL proposed by Honduras consists of the annual average of the CO_2 emissions associated with deforestation in 2000–2016, the annual average of the CO_2 emissions associated with forest degradation for 2000–2018, and the CO_2 removals associated with enhancement of forest carbon stocks resulting from conversion of non-forest land to forest in 2000–2018. The AD used for estimating the emissions from deforestation and removals from enhancement of forest carbon stocks (covering only the conversion of non-forest land to forest land and referred to as afforestation and reforestation) were derived from a map that represents forest-cover changes for 2000–2006, 2006–2012, 2012–2016 and 2016–2018. The AD used for estimating emissions from forest degradation were derived from a map that represents the canopy-cover loss in 2000–2018. Information on EFs was obtained from three NFIs, carried out in 2005–2006 (cycle I), 2011–2015 (cycle II)[13] and 2017–2019 (cycle III).

9.   The FRL presented in the modified submission, with the aim of accessing results-based payments for REDD+ activities for 2019 onward, corresponds to 8,142,121.66 t CO_2/year.[14]

10.   The proposed FRL includes the pools above-ground biomass, below-ground biomass, deadwood and litter. Regarding GHGs, the submission includes CO_2 only.

11.   The FRL proposed by Honduras is its second submission in the context of applying the stepwise approach in accordance with decision 12/CP.17, paragraph 10. Its previous national FREL was submitted on 20 January 2017 and was subject to a TA in March 2017;[15] it covered the activity reducing emissions from deforestation for the reference period 2000–2016. The previous assessed FREL corresponded to 6,552,746.47 t CO_2/year and was therefore lower than the FRL proposed in the most recent submission. The difference between them is due mainly to the latter inclusion of additional activities (see para. 7 above) and the updated estimation of the EFs, which took into consideration improvements to data and processing of the data from NFI cycles I and II and new data collected in NFI cycle III.

12.   The 15 annexes to the modified submission (see para. 3 above) were not subject to the TA, but they provided useful information that helped to clarify some of the technical issues

---

[12]   https://redd.unfccc.int/submissions.html?country=hnd.
[13]   The NFI carried out in 2011–2015 was known as the national forest and biodiversity assessment, but, for the purpose of this TA, will be referred to as an NFI. During the TA, Honduras explained that the NFI cycle lengths differ due to availability of funding.
[14]   In its original submission, Honduras proposed a national FRL of 8,142,121.66 t CO_2/year for 2000–2018. In the modified submission, the value of the proposed national FRL did not change. The difference between the original and the modified submission relates mostly to the addition of data and information that improved the transparency of the submission and corrections to the uncertainty analysis.
[15]   See document FCCC/TAR/2017/HND.

identified by the AT and increased the transparency of the submission. For the modified submission, Honduras added annexes 11–15, which provided additional information on the NFI cycles, such as on calculation procedures and results.

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

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

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

13.   Honduras included all five REDD+ activities in its submission, but the FRL includes emissions and removals for only three: reducing emissions from deforestation, reducing emissions from forest degradation, and enhancement of forest carbon stocks resulting from conversion of non-forest land to forest (through afforestation and reforestation). Emissions and removals were estimated for sustainable management of forests (i.e. for areas subject to forest management plans, or commercial plantations) but were not included in the FRL. Net emissions and removals from conservation of forest carbon stocks (i.e. for areas of forest land remaining forest land not classified as degraded forests or forests under sustainable management) were also not provided.

14.   For constructing its FRL, Honduras used methodologies from the 2006 IPCC Guidelines for estimating emissions and removals by combining AD (i.e. annual deforested, afforested and reforested, and degraded areas) with the appropriate EFs (i.e. carbon stock associated with the corresponding forest type and carbon pool).

15.   The AD used for estimating emissions from deforestation and removals from afforestation and reforestation were derived from wall-to-wall mapping of areas of deforestation and afforestation and reforestation for 2000–2006, 2006–2012, 2012–2016 and 2016–2018. For forest degradation, AD were estimated from a map developed for 2000–2018. The maps[16] were produced via a supervised classification of medium-resolution Landsat 7 and 8 imagery based on training data sourced from the interpretation of high- to very-high-resolution imagery and the NFIs. As the spatial resolution of the maps was around 30 m by 30 m, the minimum area of 1 ha specified in the forest definition was not applied. The AT considers this approach acceptable. Any area classified as deforested, afforested or reforested according to satellite imagery in any of the four periods was considered deforested, afforested or reforested for estimating AD. Areas could have been converted from forest to non-forest and back to forest in successive periods. However, according to the classification guidelines, areas classified as degraded must have been forest land remaining forest land throughout 2000–2018. Honduras did not include estimates of emissions and removals for sustainable management of forests or conservation of forest carbon stocks in the proposed FRL, which the AT notes affected the estimates derived for the other activities. In addition, forest areas under legal management (i.e. subject to approved forest management plans) or commercial plantations could be included under sustainable management of forests and conservation of forest carbon stocks, but were not included under the other REDD+ activities.

16.   The basis for the forest-cover change map was a 2012 forest-cover and land-use map generated using a map based on RapidEye imagery and a mosaic of Landsat images. Cloud-free composites were generated for 2000, 2006, 2016 and 2018[17] using medium-resolution Landsat 7 and 8 imagery. Mapping of deforestation was based on areas classified as non-forest in 2012 but classified as forest in previous epochs[18] using a CART model. Estimates of deforestation for 2012–2016 and 2016–2018 were based on areas classified as forest in

---

[16] Further information on the images and methods used for generating the AD is contained in annex 1 to the FRL submission.

[17] Using Google Earth Engine, available at https://earthengine.google.com.

[18] "Epoch" refers to the target year of the land-cover analysis.

2012 but non-forest in subsequent epochs using a CART algorithm. Afforestation and reforestation were mapped using similar methods.

17.   Mapped forest degradation covered areas that were forest land remaining forest land throughout 2000–2018, and where partial loss of canopy was detected via a supervised classification using several vegetation indices and a CART algorithm. The magnitude of forest degradation for each pixel was predicted using a random forest regressor that assigned a level of degradation from 0 (no degradation) to 1 (very degraded). In order to estimate emissions from forest degradation, the magnitude of forest degradation was multiplied by 0.7 to scale the emissions to the possible range of forest degradation (i.e. from 30 to 100 per cent canopy cover, which is a 70 per cent difference or 0.7) and by the EF for deforestation (using the carbon densities of dense forest).

18.   Honduras noted in its submission that a climax or potential vegetation map was used for attributing pixels of forest change in the maps to the four forest types (i.e. wet broadleaved forest, deciduous broadleaved forest, coniferous forest and mangrove forest).

19.   With regard to EFs, the modified submission provides information on carbon stock for the four forest types and disaggregated for the four carbon pools: above-ground biomass, below-ground biomass, deadwood (which includes stumps, standing dead trees and deadwood lying on the forest floor) and litter. Information on biomass stock for each of the pools was derived using formulae[19] in combination with information collected during the three NFI cycles.[20] To estimate tree above-ground biomass, biometric data (on diameter at breast height, and height) were used with two allometric models (one for coniferous and the other for broadleaved species; for the latter, information on density was also necessary[21]). Below-ground biomass was derived as a function of above-ground biomass applied at the tree level and then aggregated at the plot level.[22]

20.   Volume of stumps was obtained using Smalian's formula (cited in FAO, 1980), while volume of lying deadwood was obtained as a function of the diameter of each piece that intersects with defined transects.[23] In both cases, the volumes were converted into biomass and then into carbon using wood basic densities and carbon fractions appropriate to the decomposition status of the wood.[24] For litter, the wet biomass in a subsample area of 0.5 m by 0.5 m was collected and taken to the laboratory where dry matter and carbon content were estimated.

21.   Once the carbon content had been estimated for each tree, stump, piece (lying deadwood) or litter, the values were aggregated and appropriate formulae applied for deriving the estimates of biomass stock for each forest type and for each NFI cycle. The estimates for each of the three NFI cycles were averaged to derive the biomass estimates per forest type. Estimates of carbon stock for the carbon pools were obtained by multiplying the resulting biomass by appropriate carbon fractions (taken from Alberto and Elvir, 2005; and the 2006 IPCC Guidelines). These estimates were then multiplied by 44/12 to express carbon stocks in terms of CO_2 emissions by forest type and pool.

22.   Honduras estimated carbon densities for each of the three NFI cycles and used the average to derive the EFs. The carbon stocks estimated in the three NFI cycles differ, showing an increase for all forest types from cycle I to II and a decrease from cycle II to III. The estimates of carbon stock for cycles I and II were recalculated between the first FREL and

---

[19] See table 8 and section 4.2.5 of the modified submission for information on the equations and methods used.

[20] Information on lying deadwood and litter was collected only during cycles II and III.

[21] The densities used to estimate above-ground biomass in broadleaved species were taken from the Dryad database (available at http://datadryad.org/resource/doi:10.5061/dryad.234). If density was not available at the species level, an average value was derived at the level of the genus or, if necessary, the family. If this information was not available for a given species, the average density value for tropical Mexican and South American species was used (0.6277 g/cm^3).

[22] Honduras used the formula from Cairns et al. (1997) applied at the plot level as it applies to above-ground biomass, expressed in t dry matter/ha.

[23] According to Honduras, transect configuration and the sample unit size differed in each of the NFI cycles.

[24] See tables 10–11 of the modified submission for information on carbon fractions and wood densities.

second FRL submission as a result of some improvements to the data and inference procedure, which led to a reduction in the estimated carbon densities, especially for mangrove.

23.   For each forest type, the removal factors used for estimating the removals from enhancement of forest carbon stocks (i.e. afforestation and reforestation) were derived from the increment in standing stock volume (expressed in m^3/ha/year) measured in NFI cycles I and II. These increments were combined with basic densities, expansion factors, root-to-shoot ratios and carbon fractions in order to derive the removal factor per forest type expressed in t C/ha/year.

24.   The AD and EFs and/or removal factors used for estimating emissions and removals were integrated by multiplying the parameters for each forest type and each activity. However, the operational definitions of the forest types used for developing AD and EFs differed. While a climax or potential vegetation map was used to attribute the forest-cover changes to different forest types (see para. 18 above), field data were used to attribute each sample unit of the NFI to each forest type.

25.   Honduras conducted an uncertainty analysis of the AD, EFs and FRL. The uncertainty analysis for the AD was based on accuracy assessments following the good practice defined in Olofsson et al. (2014) and on multiple interpreters collecting data for the same points. The AT considers this approach extraordinary as a quality assurance/quality control measure for ensuring accuracy of the estimates and commends the Party for the additional effort. The uncertainty of carbon densities is based on standard errors estimated using closed-form formulae of variance for the applicable estimators. The uncertainties of emissions and removals presented in the modified submission are based on a Monte Carlo simulation and cover emissions from deforestation and forest degradation, and removals from enhancement and conservation of forest carbon stocks. The Monte Carlo simulation assumes normal distribution of all parameters.

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

26.   The FRL proposed by Honduras is its second submission in the context of applying the stepwise approach in accordance with decision 12/CP.17, paragraph 10. The previous FREL submission was subject to a TA in 2017. In its most recent submission, Honduras described changes from previously submitted information in accordance with decision 12/CP.17, annex, paragraph (b). The Party described the following changes:

        (a)   Inclusion of additional REDD+ activities (see para. 13 above);

        (b)   Use of an extended reference period of 2000–2018 for the additional REDD+ activities.

27.   During the TA, the AT identified the following differences in methods and data used between Honduras's previous FREL and most recent FRL submission:

        (a)   Modification of the AD used for estimating emissions from deforestation, taking into consideration the inclusion of additional REDD+ activities (see para. 29 below);

        (b)   Recalculation of carbon density estimates for NFI cycles I and II;

        (c)   Inclusion of an uncertainty analysis for the FRL.

28.   During the TA, the AT sought clarification on a number of issues regarding how the FRL was constructed, such as on the estimation of AD and EFs and the consistency of these parameters with the operational definitions of forest types (see para. 24 above). In response, Honduras referred the AT to information included in the annexes to the FRL submission. In response to a request of the AT for greater transparency of the information used in constructing the FRL, Honduras more clearly described (including additional information) the steps in constructing the FRL and made methodological improvements to the uncertainty

analysis. The AT commends Honduras for providing more information, which facilitated the assessment of the submission and significantly increased its transparency.

29. Although Honduras included all five REDD+ activities in its submission, the FRL includes only emissions from deforestation and forest degradation and removals from enhancement of forest carbon stocks via afforestation and reforestation (see para. 13 above). Notably, the area under conservation of forest carbon stocks could be assumed to be a sink, which, under a 'business as usual' scenario, would continually remove CO_2 from the atmosphere. However, with the implementation of REDD+ activities this sink is likely to be 'stronger' than under a 'business as usual' scenario and could result in emission reductions. Therefore, the AT notes the inclusion of emissions and removals from sustainable management of forests and conservation of forest carbon stocks as an area for future technical improvement.

30. Honduras provided clear definitions of all REDD+ activities in its modified submission, together with the criteria for their application. In response to questions from the AT regarding the operationalization of the definitions, Honduras clarified the aspects of the definitions that were applied or not applied and provided a decision tree in section 3.5 of the modified submission that enables confirmation that there was no overlap of activities. In addition, Honduras clarified that, as part of its future technical improvements, it is considering applying many of the criteria included in the REDD+ definitions, such as the consideration of areas of forest converted to agroforestry systems, which was identified as an area for technical improvement in the assessment of its previous FREL submission. The AT notes the continuation of work on the operationalization of the definitions of REDD+ activities as an area for future technical improvement and commends Honduras for its efforts to increase the transparency of its submission.

31. Regarding the AD used for estimating areas of deforestation, afforestation and reforestation, the Party improved the transparency of its submission by correcting the description of the mapping procedures and providing more information on the differences between the methods used to derive the AD for deforestation and forest degradation. The AT was able to confirm that the maps of deforestation and afforestation and reforestation were produced in accordance with applicable good practices for map production. However, there are some issues with the accuracy and uncertainty of the maps (see para. 39 below). The AT is of the view that, since Honduras is using wall-to-wall mapping for different subperiods, it would not be difficult to apply IPCC approach 3 to land representation, enabling more detailed estimation of emissions and removals from deforestation and afforestation and reforestation, and notes this as an area for future technical improvement.

32. Honduras also used wall-to-wall methods for estimating AD for forest degradation (see para. 17 above). In response to questions from the AT, the Party improved the transparency of its submission by correcting the description of the mapping procedures and providing additional information on the differences between the methods used to derive the AD for deforestation and forest degradation. On the methods used, the AT noted three main issues that represent areas where the Party could consider technical improvement:

(a) Using the random forest classifier as a regressor tends to lead to overestimation of degradation intensity in less degraded classes and underestimation of degradation intensity in more degraded classes because the values for several trees are averaged, resulting in the algorithm pushing the predictions towards the mean and thus failing to account for extreme values (Xu et al., 2016). One approach to correcting this is to consider using a linear regression of the plot between the predictions and the reference data as the training set, followed by using this regression for producing a new forest degradation map;

(b) Using a long analysis period for mapping and quantifying forest degradation is likely to lead to underestimation of the associated emissions because they are net emissions (e.g. from areas that have partially lost canopy with subsequent regrowth or partial recovery that would not be detected). The AT notes that this will represent a large source of bias during the monitoring period when Honduras tries to compare emissions over a longer time period (i.e. net emissions) with those over a shorter period (i.e. gross emissions);

(c) More accurate estimation of emissions from deforestation is not possible using the current methods because deforestation events in degraded forest cannot be correctly

represented given the assumption that all deforestation occurs in non-degraded forest. Furthermore, the methods assume that carbon density estimates derived from the NFI represent non-degraded forests, which might not be the case because a wide range of forest in different stages of degradation is considered in the NFI.

33. The EFs are carbon densities obtained by averaging estimates derived from the three NFI cycles (see para. 22 above). The above-ground biomass estimates were derived using methods that are in accordance with good practice for forest inventories and were transparently presented. However, Honduras used the formula from Cairns et al. (1997) intended to be used at plot level to estimate the below-ground biomass at tree level. As the estimate is expressed in t dry matter/ha, the formula cannot be used at tree level. Hence, the AT identifies the correct application of the Cairns et al. formula as an area for future technical improvement.

34. Carbon densities for stumps, lying deadwood and litter were estimated in accordance with best practice (see para. 20 above). In response to comments from the AT, Honduras corrected the decomposition classes, densities and carbon fractions in the modified submission, which the AT acknowledges.

35. The AT noted that the estimates of tree biomass, stumps, pieces (for lying deadwood) and plot (for litter) varied significantly between NFI cycles (see paras. 20–21 above). Instead of its current method, the Party could consider using the method for estimating carbon stock changes from the 2006 IPCC Guidelines. In response to a request from the AT, the Party clarified that the variation in estimates between cycles is due in part to methodological differences and the impact of deforestation and diseases, and that it was not possible to estimate carbon stock change in NFI cycle III because the methods used (i.e. the type of sample unit applied) were different. Hence, the AT notes the use of results from several NFI cycles for estimating carbon stock change as an area of future technical improvement. Moreover, the carbon stock of non-forest land is assumed to be zero, resulting in an approach that overestimates emissions from deforestation and removals from afforestation and reforestation, and is not in line with the 2006 IPCC Guidelines. Hence, the AT notes the consideration of net emissions after deforestation in line with the 2006 IPCC Guidelines as an area for future technical improvement. The AT commends Honduras for its efforts to estimate carbon stock changes over several NFI cycles and welcomes its ongoing efforts to complete its improved NFI cycle III, as well as its plans to undertake a fourth NFI cycle in the near future.

36. With regard to the removal factors used for estimating removals from enhancement of forest carbon stocks, Honduras improved the transparency of its submission by including the results from the estimation of removals for each forest type and the associated equations applied. However, information on the sources of many of the parameters employed in estimating the removals (see para. 23 above) was not provided in the modified submission. Hence, the AT notes the improvement of completeness and transparency in this regard as an area for future technical improvement. Moreover, the reported average annual removals were underestimated because they were estimated by multiplying AD (in ha/year) by the removal factors (in t C/ha/year), resulting in estimates expressed in t C/year of the average annual removals in areas converted to forest in a single year. Hence, the AT notes the correction of the approach for calculating annual removals as an area for future technical improvement.

37. In relation to the integration of AD and EFs (see para. 24 above), the AT noted that the operational application of the definitions of forest and forest types used for developing the AD and EFs might differ, which could potentially lead to bias. A solution could be to overlap the climax or potential vegetation maps with the NFI sample units, as suggested by Birigazzi et al. (2017), in order to assess the possible bias induced. Moreover, the AT noted that, in estimating removals Honduras multiplied the AD (in ha/year) by the removal factors (in t C/ha/year), which might lead to removals being greatly underestimated because only one year of growth is considered for areas converted from non-forest to forest.

38. Honduras made a significant improvement compared with its previous FREL submission by providing an uncertainty analysis for the AD, EFs and FRL (see para. 25 above), and the AT commends Honduras for its efforts.

39. The uncertainty of the AD for reducing emissions from deforestation and enhancement of forest carbon stocks were estimated using a specific accuracy assessment (see para. 25 above). However, the accuracy assessment used polygons of unequal size as sample units and the Party did not apply the correct statistical formulae for estimating the uncertainty of the AD. The AT shared the appropriate formulae based on Cochran (1977) during the TA and notes the use of the correct formulae as an area for future technical improvement. The formulae applied by Honduras resulted in errors in the calculations, leading to significant underestimation of the uncertainty of the AD because the variance in the estimates was not correctly calculated. The AT conducted a recalculation using the appropriate formulae and found that the statistical estimate calculated using an unbiased estimator and the estimate derived from the forest-cover change map differed significantly (i.e. 900,785 ha deforestation compared with 638,682 ha reported by Honduras). The main reason for this difference is an omission of residual areas of deforestation from the non-forest map class, which caused the mapped area of deforestation to be increased by 282,609 ha. This suggests not only a possible underestimation of emissions, but also, more importantly, that the cartographic work needs to be improved for the non-forest map classification. One approach could be to improve the non-forest map classes by carefully identifying and remapping any residual areas of deforestation in the non-forest map class, which could help to improve the estimates of deforestation. The existing accuracy assessment could be completed simply by adding these newly mapped deforested areas into the confusion matrix. The AT notes that accuracy assessments are not a means to an end, but a tool for incrementally improving the cartography of land maps.

40. Accuracy assessments were also conducted for the cartography used to derive the AD for estimating emissions and removals from forest degradation, conservation of forest carbon stocks and sustainable management of forests. However, they were not in accordance with best practice (as proposed in Olofsson et al., 2014; and Global Forest Observations Initiative, 2020) because the assessment is of user's accuracy (i.e. commission errors) only, and not of producer's accuracy (i.e. omission errors). The AT is of the view that understanding the omission errors would be useful for identifying possible underestimations and informing further improvements required to the forest-cover change maps.

41. The uncertainty of EFs was estimated by combining standard errors using simple error propagation equations (equations 3.1 and 3.2 from the 2006 IPCC Guidelines), which is in line with IPCC approach 1 to error propagation. The uncertainty of EFs for each forest type was then combined with the uncertainty of the AD in a Monte Carlo simulation framework, which is considered IPCC approach 2 (see para. 25 above). The Monte Carlo simulation was introduced as a result of technical inputs from the AT during the TA. The AT commends Honduras for its efforts, but notes several issues that need to be addressed:

(a) The probability density function used for estimating AD was erroneously defined as a result of using different units for the central value parameter (expressed in ha) and the standard error (expressed as a percentage);

(b) The simulated estimates of emissions from forest degradation and removals from enhancement of forest carbon stocks were overestimated because the EFs used were the same as those used for estimating emissions from deforestation;

(c) The relative uncertainty resulting from the Monte Carlo simulation, expressed as a percentage, was incorrectly calculated because arithmetical averages were used instead of medians, and the total uncertainty was not estimated as the difference between the 2.5th and 97.5th percentiles of all simulations divided by two;

(d) The uncertainties of emissions from deforestation and forest degradation, and removals from enhancement of carbon stocks were combined with the uncertainty of carbon stocks for conservation of carbon stocks, resulting in an overall uncertainty that does not represent the actual uncertainty of the FRL.

42. According to decision 13/CP.19, annex, paragraph 2(a), the TA should assess the extent to which the FREL or FRL maintains consistency with corresponding anthropogenic forest-related GHG emissions by sources and removals by sinks reported in the national GHG inventory. The data and information on emissions provided in the GHG inventory included

in the NC3[25] and first BUR[26] of Honduras submitted in 2020 are only partially consistent with the data and information used in constructing the FRL, particularly in terms of the emission and removal factors and AD used for estimating deforestation. For the national GHG inventory, the AD and EFs used in constructing the previous FREL were used, but the removal factors used for the latest FRL were used to estimate the removals from forest land remaining forest land. The AT notes that the use of data that are consistent with those used for constructing the FREL or FRL for the GHG inventory can be considered a significant improvement since there was no consistency between the data used for the previous FREL submission and the GHG inventory. Although there are still some inconsistencies, the AT commends Honduras for its efforts to improve consistency between the estimated forest-related GHG emissions reported in the national GHG inventory and the FRL.

43.   In assessing the extent to which the information used in constructing the FRL is consistent with the information submitted to other international organizations, the AT noted that Honduras used the forest-cover data from its previous FREL submission for reporting to FAO for the 2020 Global Forest Resources Assessment (FAO, 2020) instead of the more up-to-date information used in constructing the most recent FRL, which was not available at the time. The national forest definition used for the FRL is consistent with that reported to FAO; however, it should be noted that the forest definitions used by countries for reporting to the UNFCCC and FAO usually differ because FAO has its own forest definition to allow for standardization and consolidation of the results reported by countries. The AT commends Honduras for its efforts to ensure consistency across its reporting to international organizations.

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

44.   As the proposed FRL is based entirely on historical data, no assumptions about future changes to domestic policies were included in the submission. Information on the causes of deforestation and possible future trends was included in the submission as part of the description of national circumstances.

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

45.   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.

46.   The pools included in the Party's FRL are above-ground biomass, below-ground biomass, deadwood and litter. Soil organic carbon in mineral and organic soils is the only pool not included. With regard to GHGs, only CO_2 emissions were estimated and included.

47.   The AT noted that the Party did not provide sufficient justification for considering the soil organic carbon pool and non-CO_2 gases insignificant and excluding them. During the TA of the previous FREL submission, the previous AT acknowledged lack of data as the reason provided by Honduras for excluding the soil organic carbon pool. Given that the significance of the emissions associated with omitted carbon pools and gases should be assessed in order to comply with decision 12/CP.17, annex, paragraph (c), the AT notes this as an area for future technical improvement as part of the stepwise approach.

48.   With regard to emissions from the soil organic carbon pool, the AT noted that CO_2 emissions from soil management and land-use change reported in the national GHG inventory included as part of the NC2 submitted in 2012 represented about 57 per cent of the emissions from biomass in forest and pastures in conversion,[27] which, on the basis of the comparison of emissions from soils with those from biomass, might indicate some significance of the soil organic carbon pool. At the same time, the AT acknowledges the lack of underlying information for properly estimating such emissions, and notes the need for

---

[25] Available at https://unfccc.int/documents/249921.

[26] Available at https://unfccc.int/BURs.

[27] According to the NC2 (available at https://unfccc.int/documents/107016), in 2000, CO_2 emissions from living biomass in forest and pastures in conversion totalled 35,241.00 Gg, while CO_2 emissions from soil management and land-use change amounted to 20,101.12 Gg.

caution when interpreting the estimates. Although no explicit information on emissions from organic soils was included in the FRL submission, the AT noted that there are no organic soils (i.e. histosols) in Honduras (Gardi et al., 2015). Hence, it can be concluded that emissions from organic soils are likely to be insignificant.

49. The GHG inventory included as part of the Party's first BUR and NC3 did not provide information on non-CO_2 emissions for either 2005 or 2015. During the TA of the previous FREL submission, Honduras provided ample information on and justification for excluding non-CO_2 emissions from forest fires, which was accepted by the AT at the time. Although it is of the view that the exclusion of this source of emissions from the FRL submission is acceptable, the AT notes that the inclusion of a justification for this exclusion remains an area for future technical improvement (see para. 42 above).

50. The AT acknowledges that Honduras included all five activities identified in decision 1/CP.16, paragraph 70, in accordance with its national capabilities and circumstances. The AT notes that Honduras did not include emissions and removals from sustainable management of forests or conservation of forest carbon stocks in its FRL even though data seem to be available for reporting on these activities (see para. 13 above). Moreover, removals from forest land remaining forest land were not included for enhancement of forest carbon stocks. The AT notes that the inclusion of data on removals and emissions from these activities remains an area for future technical improvement, but confirms that Honduras included the most significant activities and commends the Party for the technical improvements made since the previous FREL submission.

4. Definition of forest

51. Honduras provided in its submission the definition of forest used in constructing its FRL. It defines forest as a natural or planted area of trees (at any stage of growth) that may or may not contain shrubs, which covers a minimum area of 1 ha; can produce wood, other forest products, goods and ecosystem services for the benefit of society; has an impact on the water regime, soil and climate; and provides habitat for wildlife. The forest cover of such tree associations has to be greater than 10 per cent, with a minimum tree height of 2 m in mangrove forests and 4 m in other forest ecosystems. Moreover, forest land may be temporarily unstocked as a consequence of anthropogenic actions or natural circumstances, but must present the conditions, features and inclination to become forest again. The Party confirmed during the TA that the definition was established in a participatory manner with the aim of tailoring it to the national REDD+ policy context and activities as well as to sustainable forest management within the country.

52. The AT noted that Honduras made a few operational decisions relating to its application of the definition. Firstly, AD were estimated considering a minimum tree cover of 30 per cent, as the 10 per cent threshold impeded the thematic discrimination between forest and non-forest. Secondly, the AD were based on maps generated from satellite imagery with 30 m resolution, so areas below the minimum area of 1 ha were classified as forest. Thirdly, the NFI data assume a minimum forest area of 0.5 ha and a forest cover threshold of 10 per cent, and agroforestry systems were not considered forest in the national forest assessments. The AT acknowledges these adjustments to the forest definition based on operational decisions and commends the Party for providing more information on the application of the definition. Nevertheless, the AT notes the use of a consistent definition of forest for deriving AD and EFs as an area for future technical improvement (see para. 30 above).

III. Conclusions

53. The information used by Honduras in constructing its FRL for reducing emissions from deforestation, reducing emissions from forest degradation, enhancement of forest carbon stocks, sustainable management of forests and conservation of forest carbon stocks is only partially transparent and complete and therefore not fully in accordance with the guidelines for submissions of information on reference levels.

54. The FRL presented in the submission is the Party's second reference level. The previous FREL was submitted in January 2017 and was subject to a TA in 2017; the submission covered the activity reducing emissions from deforestation for the reference period 2000–2016.

55. The FRL presented in the modified submission is for reducing emissions from deforestation for the reference period 2000–2016 and reducing emissions from forest degradation and enhancement of forest carbon stocks for 2000–2018, and corresponds to 8,142,121.66 t CO_2/year.

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

57. As a result of the facilitative interactions with the AT during the TA, Honduras 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 (except for modifications made to the uncertainty analysis), and commends Honduras for its efforts. The new information provided in the modified submission, including the data, are available online[28] and examples of how estimates of CO_2 emissions and removals were calculated were shared with the AT, thereby increasing the reproducibility of the FRL.

58. The AT notes that, overall, the FRL maintains consistency, in terms of sources of AD and EFs, with the GHG inventory included in Honduras's NC3 and first BUR.[29]

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

(a) Including emissions and removals from sustainable management of forests and conservation of forest carbon stocks (see para. 29 above);

(b) Continuing work on the operationalization of the definitions of all REDD+ activities (see para. 30 above);

(c) Applying IPCC approach 3 to land representation to enable more accurate estimation of emissions and removals from deforestation and enhancement of forest carbon stocks (see para. 31 above);

(d) Improving the methodology used for estimating emissions from forest degradation; for example, using shorter time periods of analysis to reflect net changes and mitigate the bias caused by the random forest models in the case of extreme values (see para. 32 above);

(e) Improving the application of the formula from Cairns et al. (1997) at the plot level in estimating below-ground biomass (see para. 33 above);

(f) Exploring the possibility of using the results from several NFI cycles and the relevant IPCC methodology for estimating changes in carbon stock in tree biomass, stumps, lying deadwood and litter (see para. 35 above);

(g) Revising the assumption of zero carbon stock in non-forest land, which results in overestimates of emissions from deforestation and removals from afforestation and reforestation (see para. 35 above);

(h) Including information on the sources of the parameters used for estimating removals, to enhance transparency and completeness, and correcting the approach to calculating average annual removals (see para. 36 above);

---

[28] http://sigmof.icf.gob.hn and http://sigmof.icf.gob.hn/?page_id=4661.

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

(i)   Applying the correct statistical formulae (e.g. from Cochran, 1977) for estimating the uncertainty of AD (see para. 39 above);

(j)   Using the results of the accuracy assessment to improve the cartographic work, particularly the non-forest map classification (see para. 39 above);

(k)   Understanding the omission errors associated with the estimation of AD so as to avoid underestimations and further improve the forest-cover change maps (see para. 40 above);

(l)   Improving the uncertainty analysis (Monte Carlo simulation) by correcting the procedure (see paras. 41 above);

(m)   Further improving the consistency of the estimates between the national GHG inventory and the FRL (see para. 42 above);

(n)   Maintaining consistency of the operational forest definition used for deriving AD and EFs across the REDD+ activities (see paras. 37 and 52 above).

60.   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 from the submission are likely to be insignificant in the context of the FRL. Nevertheless, the AT identified the collection of information on the omitted carbon pool (i.e. soil organic carbon) and associated carbon stocks and their dynamics following deforestation events as an additional area for future technical improvement, so that the significance of the pool and its contribution to overall emissions may be assessed to facilitate the decision to either exclude or include the pool in future submissions. In addition, the omission of any pools or gases should be justified in future submissions (see paras. 47–48 above).

61.   The AT acknowledges and welcomes the Party's intention to continue working on:

(a)   Developing more species-specific allometric equations;

(b)   Operationalizing the definitions of REDD+ activities.

62.   In conclusion, the AT commends Honduras 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 Honduras'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.[30] The AT also acknowledges that the TA was an opportunity for a rich, open, facilitative and constructive technical exchange of information with Honduras.

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

---

[30] 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 Honduras

Main features of the FRL		Remarks
Proposed FRL	8 142 121.66 t CO_2/per year	All five REDD+ activities were included, but the proposed FRL includes only the emissions and removals from deforestation, forest degradation and enhancement of forest carbon stocks (i.e. afforestation and reforestation). Carbon density after a deforestation event was assumed to be zero (see paras. 7, 13, 29, 35 and 50 of this document)
Type and reference period of FRL	FRL = average of historical emissions and removals in 2000–2018	The reference period is 2000–2016 for reducing emissions from deforestation and 2000–2018 for the other activities (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 Conservation of forest carbon stocks Sustainable management of forests Enhancement of forest carbon stocks	Honduras provided definitions of all REDD+ activities, information on the operationalization of those definitions (criteria considered and how they were applied) and a decision tree to show that there was no overlap. There are many aspects of the definitions that were not applied in practice (see paras. 7, 13 and 30 of this document)
Pools included	Above-ground biomass Below-ground biomass Deadwood Litter	Estimates were derived from data from three NFI cycles. The soil organic carbon pool was not included owing to lack of information (see paras. 10, 19, 22, 23, 33, 35, 47 and 48 of this document)
Gas included	CO_2	See paragraphs 10 and 46 of this document
Forest definition	Included	Forest is defined as a natural or planted association of trees (at any stage of the life cycle) that may or may not be accompanied by shrubs or other layers, which covers a minimum area of 1 ha, can produce wood, other forest products, goods and ecosystem services for the benefit of society, has an impact on the water regime, soil and climate, and provides habitat for wildlife. The forest cover of such tree associations has to be greater than 10 per cent, with a minimum tree height of 2 m for mangroves and 4 m for other ecosystems. For constructing the FRL, a forest cover threshold of 30 per cent and a minimum area of less than

Main features of the FRL		*Remarks*
		1 ha were used (see paras. 51–52 of this document)
Consistency with latest GHG inventory	Methods used for estimating the FRL are partially consistent with those used for the latest GHG inventory (2015)	For the GHG inventory, the AD and EFs used for the previous FREL were used but the removal factors used for the latest FRL were used to estimate the removals from forest land remaining forest land (see para. 42 of this document)
Description of relevant policies and plans	Included	See paragraph 44 of this document
Description of assumptions on future changes to domestic policies, if included in the construction of the FRL	Not applicable	–
Description of changes to previous FREL	Included	The submission provided the main elements of and differences between the FREL submitted in 2017 and the FRL submitted in 2020 (see paras. 11, 26 and 27 of this document)
Identification of future technical improvements	Included	Several areas for future technical improvement were identified (see para. 59 of this document)

Annex II

Documents and information used during the technical assessment

A. Reference documents

First BUR of Honduras. Available at https://unfccc.int/BURs.

First FREL and second FRL submissions of Honduras. Available at https://redd.unfccc.int/submissions.html?country=hnd.

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

"Guidelines for submissions of information on reference levels". Annex to decision 12/CP.17. Available at https://unfccc.int/sites/default/files/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.

NC2 and NC3 of Honduras. Available at https://unfccc.int/non-annex-I-NCs.

Report on the TA of the proposed FREL of Honduras submitted in 2017. FCCC/TAR/2017/HND. Available at https://redd.unfccc.int/submissions.html?country=hnd.

B. Other documents

The following references have been reproduced as received:

Annexes supporting the FRL submission:

1. Methodology for estimating emissions and removals from REDD + activities.

2. Estimation Methods for the NFI of Honduras.

3. Manual for the collection of field data for the NFI of Honduras; cycle III.

4. Uncertainties of EFs.

5. Protocol on the definition of deforestation.

6. Protocol on the definition of forest degradation.

7. Protocol on the definition of enhancement of forest carbon stocks.

8. Protocol on the definition of conservation of forest carbon reserves.

9. Protocol on the definition of sustainable forest management.

10. Summary of definitions and considerations for REDD + activities.

11. Calculation procedure used in NFI Cycles I and II Honduras.

12. Calculation procedure used in NFI Cycle III.

13. NFI results 2005–2006.

14. Supervision of the second stage of the National Forest and Biodiversity Assessment 2016.

15. List of species and densities in NFI Cycles I, II and III.

Alberto D and Elvir JA. 2005. Acumulación y fijación de carbono en biomasa aérea de *Pinus oocarpa* en bosques naturales de Cabañas, La Paz. *Tatascán*. 17(2): pp.3–12.

Birigazzi L, Gamarra J and Gregoire T. 2017. Unbiased emission factor estimators for large scale forest inventories: Domain assessment techniques. *bioRxiv*. Available at http://dx.doi.org/10.1101/138131doi.

Cairns M, Brown S, Helmer E, et al. 1997. Root biomass allocation in the world's upland forests. *Oecologia*. 111(1): pp.1–11. Available at https://doi.org/10.1007/s004420050201.

Cochran, WG. 1977. *Sampling Techniques*. *3rd Edition*. New York: John Wiley & Sons. Available at https://glad.geog.umd.edu/Potapov/_Library/Cochran_1977_Sampling_Techniques_Third_Edition.pdf.

FAO. 1980. *Estimación del volumen forestal y predicción del rendimiento; Vol 1. Estimacion del volumen.* Rome, Italy. Available at http://www.fao.org/docrep/016/ap353s/ap353s00.pdf.

FAO. 2020. *Global Forest Resources Assessment 2020*. Rome: Food and Agriculture Organization of the United Nations. Available at http://www.fao.org/forest-resources-assessment/2020.

Gardi C, Angelini M, Barcelo S, et al. (eds.). 2015. *Soil Atlas of Latin America and the Caribbean*. European Commission, Luxembourg: Publications Office of the European Union, L-2995 Luxembourg.

Global Forest Observations Initiative (GFOI). 2020. *Integrating remote-sensing and ground-based observations for estimation of emissions and removals of greenhouse gases in forests: Methods and Guidance from the Global Forest Observations Initiative*. Edition 3.0. Rome, Italy: GFOI. Available at https://www.reddcompass.org/download-the-mgd.

Olofsson P, Foody G, Herold M, et al. 2014. Good practices for estimating area and assessing accuracy of land change. *Remote Sensing of Environment*. 148: pp.42–57. Available at https://doi.org/10.1016/j.rse.2014.02.015.

Xu L, Saatchi SS, Yang Y, et al. 2016. Performance of non-parametric algorithms for spatial mapping of tropical forest structure. *Carbon Balance and Management*. 11(1):18. Available at https://doi.org/10.1186/s13021-016-0062-9.