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Report on the technical assessment of the proposed forest reference level of Bangladesh submitted in 2019

Summary

This report covers the technical assessment of the voluntary submission of Bangladesh 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 Bangladesh 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, Bangladesh developed a national FRL. The FRL presented in the original submission, for the reference period 2000–2015, corresponds to 295,451 tonnes of carbon dioxide equivalent per year. As a result of the facilitative process during the technical assessment, the FRL was modified to 374,253 tonnes of carbon dioxide equivalent per year. The assessment team notes that the data and information used by Bangladesh in constructing its forest reference level are transparent, complete and in overall accordance with the guidelines contained in the annex to decision 12/CP.17. This report contains the assessed FRL and a few areas identified by the assessment team for future technical improvement in accordance with the provisions on the scope of the technical assessment contained in the annex to decision 13/CP.19.

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Contents

Abbreviations and acronyms

AD	activity data
AT	assessment team
COP	Conference of the Parties
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
DBH	diameter at breast height
EF	emission factor
FREL	forest reference emission level
FRL	forest reference level
GHG	greenhouse gas
IPCC	Intergovernmental Panel on Climate Change
NC	national communication
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 Bangladesh on its proposed FRL,[1] submitted on 3 January 2019, in accordance with decisions 12/CP.17 and 13/CP.19. The TA took place (as a centralized activity) from 18 to 22 March 2019 in Bonn and was coordinated by the secretariat.[2] The TA was conducted by two land use, land-use change and forestry experts from the UNFCCC roster of experts[3] (hereinafter referred to as the AT): Markus Didion (Switzerland) and Jean-Paul Kibambe Lubamba (Democratic Republic of the Congo). In addition, Gervais Ludovic Itsoua Madzous, an expert from the Consultative Group of Experts, participated as an observer[4] during the centralized activity in Bonn. The TA was coordinated by Peter Iversen (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, Bangladesh submitted its proposed FRL on a voluntary basis. The proposed FRL is one of the elements[5] to be developed in the implementation of 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 or FRL, as referred to in decision 12/CP.17, paragraph 13, shall be subject to a TA in the context of results-based payments.

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

4. The TA of the FRL submitted by Bangladesh was undertaken in accordance with the guidelines and procedures for the TA of submissions from Parties on proposed FRELs and/or FRLs.[8] This report on the TA was prepared by the AT following the same guidelines and procedures.

5. Following the process set out in those guidelines and procedures, a draft version of this report was communicated to the Government of Bangladesh. The facilitative exchange during the TA allowed Bangladesh 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, Bangladesh provided a modified version of its submission on 17 July 2019, which took into consideration the technical input of the AT. The modifications improved the clarity and transparency of the submitted FRL without needing to alter the approach used to construct it. This TA report was prepared in the context of the modified FRL submission. The modified submission, containing the assessed FRL, and the original submission are available on the UNFCCC website.[10]

B. Proposed forest reference level

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

[1] The submission of Bangladesh is available at https://redd.unfccc.int/submissions.html?country=BGD.
[2] Per decision 13/CP.19, annex, para. 7.
[3] Per decision 13/CP.19, annex, paras. 7 and 9.
[4] 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] Per decision 13/CP.19, annex, paras. 1(b) and 13–14.
[10] http://unfccc.int/8414.

FRL proposed by Bangladesh, 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 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, Bangladesh developed a national FRL that covers its entire territory. For its submission, Bangladesh 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 and/or FRLs by incorporating better data, improved methodologies and, where appropriate, additional pools.

7. The national FRL proposed by Bangladesh for the historical reference period 2000–2015 is the annual average of the CO_2 emissions associated with deforestation and forest degradation, and of the CO_2 removals associated with enhancement of forest carbon stocks.

8. The EFs were obtained from several national and subnational forest inventories, which were harmonized to account for methodological differences, while the AD used in constructing the FRL were based on national land-cover maps from 2000 and 2015 derived from satellite images.

9. The FRL presented in the modified submission, with the aim of accessing results-based payments for REDD+ activities for 2000–2015, corresponds to 374,253 t CO_2 eq/year based on emissions of 1,188,971 t CO_2 eq/year and removals of –814,718 t CO_2 eq/year.[11]

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

11. Bangladesh included in the appendix to its submission detailed information on AD and EFs at the regional level, ensuring completeness. Following comments by the AT concerning a lack of transparency with regard to the description of this information and how it is aggregated to obtain the national value of the proposed FRL, Bangladesh provided additional information and nationally aggregated data on AD and EFs in a format similar to that of the presented data (table 12 in the initial submission). The AT notes that the additional aggregated information significantly improved the transparency, reproducibility and completeness of the submission.

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

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

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

12. For the construction of its FRL, Bangladesh used the 2006 IPCC Guidelines.

13. In its FRL, Bangladesh included the activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks. The reference period is 2000–2015 for all three activities. Deforestation is defined as a land-use change due to conversion from forest to non-forest land classes. Forest degradation is identified as a reduction in the carbon stock within forest land classes, estimated as a percentage of the decrease in tree cover. Enhancement of forest carbon stocks is identified as either afforestation/reforestation defined as a conversion from non-forest to forest land

[11] In its original submission, Bangladesh proposed a national FREL of 1,122,861 t CO_2 eq/year, which considered emissions only, and a FRL of –827,410 t CO_2 eq/year, which considered removals only. The difference between the original and the modified submission is that, in the modified submission, Bangladesh presented just a FRL, which corresponds to its net emissions and removals. In addition, there are a few changes to the underlying estimates, which are due mostly to adjustments to the AD on the basis of the difference between the actual country surface area and the area obtained from satellite imagery, and an improved accuracy assessment.

classes, or forest restoration defined as an increase in the carbon stock within forest land classes, estimated as a percentage of the increase in tree cover.

14. Bangladesh used satellite images from 2000 (i.e. LANDSAT 5 and 7 with 30 by 30 m pixels) and 2015 (i.e. SPOT 6 or 7 with 6 by 6 m pixels) covering the entire territory to estimate its AD. Both images were classified to obtain land-cover maps. To account for the differences in the raster resolution of the two map sources, which resulted in greater land-cover detail in 2015 compared with 2000, Bangladesh harmonized the two land-cover maps in order to derive one consistent land-cover change map. An analysis of the accuracy of the land-cover change map indicated a high uncertainty of AD, particularly for the categories "low" and "high" with regard to forest degradation and enhancement of forest carbon stocks. Information on the percentage of tree cover on forest land obtained from the 2000 and 2015 land-cover maps and the land-cover change map was used to derive AD for the activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks. A threshold of 50 per cent tree cover on forest land in 2000 was used to identify areas of degradation and enhancement; that is, forest degradation was considered only for forest land with tree cover of >50 per cent, and enhancement of forest carbon stocks was considered only for forest land with tree cover of ≤50 per cent in 2000. In addition, two levels of intensity were identified: tree cover between 5 and 25 per cent was considered low intensity and a change of ≥25 per cent high intensity.

15. The EFs cover the pools above- and below-ground biomass of trees, and were obtained from several national and subnational forest inventories conducted in Bangladesh, which were harmonized to account for methodological differences regarding minimum and maximum DBH of measured trees, measurements of tree height and plot design. Estimates for above-ground biomass were obtained by applying a tier 1 approach using a pantropical allometric equation based on tree DBH and height. Tree DBH was measured for all trees on a sample plot, whereas tree height was measured only for a subsample of trees. Height was estimated for all trees on the basis of this subsample in order to apply the allometric equation to above-ground biomass (see para. 23 below). Use of the model to estimate tree height can be considered a country-specific tier 2 approach.

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

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

16. As mentioned in paragraph 14 above, harmonization of land-cover information was necessary because of the differences in the spatial resolution of the imagery from 2000 and 2015, resulting in more land-cover classes in 2015 owing to the greater level of detail in the imagery. This was carried out by creating polygons in the classified and harmonized imagery for 2000 and 2015 to produce a land-cover change map identifying contiguous areas of individual land-cover classes and the spatial extent of changes from one cover class to another. The AT commends the Party for its efforts to ensure consistent land-cover maps for the two points in time. It notes that Bangladesh may wish to consider adding details on the land-cover change analysis in its future submissions. This may include the additional information that was provided to the AT during the TA as well as the reason for converting the raster images to polygons, which probably resulted in additional uncertainty related to the land-cover change evaluation.

17. Although the data from satellite imagery available for only two points in time, 2000 and 2015, are not sufficient to infer a trend, the AT considers that the approach is suitable considering that (1) the Party has established in this initial submission the groundwork for the planned biannual tree cover change area estimate update; (2) there are limitations regarding data availability, financing and personnel for analysis; (3) the selected period reflects the effect of implemented policies for reducing deforestation and degradation; (4) two national land-cover maps are being developed for 2005 and 2010 to increase the accuracy of the emission and removal estimate data used in future submissions; (5) the dates of the selected images coincide with the sampling dates of the forest inventories; and (6) literature in support of the analysis used in this submission is presented.

18. AD specific to each of the three activities considered by Bangladesh were derived from the land-cover change map. Since emissions and removals from reducing emissions from forest degradation and enhancement of forest carbon stocks were estimated by a decrease or increase, respectively, in tree cover percentage, the Party needed to identify the areas of forest land remaining forest land that experienced a change in tree cover, and the extent of the change.

19. On the basis of the land-cover change map, Bangladesh estimated the corresponding area for each of the three activities. It used a threshold of 50 per cent tree cover in 2000 for identifying degradation and restoration, as mentioned in paragraph 14 above. The AT sought clarification from the Party on the use of this 50 per cent tree cover threshold, and also on forest degradation in areas with tree cover of ≤50 per cent in 2000 and enhancement of forest stocks in areas with tree cover of >50 per cent in 2000, which are currently not considered. The AT considers that the information provided by Bangladesh during the TA helped to improve the transparency and reproducibility of its FRL submissions and helped to build confidence in the emission estimates.

20. Because the emission and removal estimates for the activities reducing emissions from forest degradation and enhancement of forest carbon stocks are based on tree cover percentages, the AT notes that Bangladesh may wish to consider including maps showing tree cover percentage information for 2000 and 2015 in future submissions.

21. The AT evaluated the accuracy of the land-cover change map, which showed that the areas of low and high levels of degradation in particular as well as high level of enhancement of forest carbon stocks are associated with high uncertainty. The uncertainty may be reduced by aggregating areas of low and high intensity. This may be reasonable because currently EFs for low- and high-intensity degradation and enhancement, respectively, are derived as proportions of the initial tree cover based on a linear relationship.

22. To establish EFs, Bangladesh used information from past forest inventories that were carried out on different scales and with different designs. Data from six inventories carried out between 1997 and 2014 were used and harmonized to obtain consistent estimates for above-ground tree biomass. EFs were estimated for each land-cover class identified in the analysis of the AD. In response to the exchange during the TA, Bangladesh provided additional information in its revised submission. The AT considers that, in future FREL/FRL submissions, Bangladesh could provide further details on the inventory data demonstrating how consistent estimates were obtained taking into consideration the differences in the designs and purposes.

23. Above-ground tree biomass was estimated on the basis of tree volume estimates and wood densities. The volume of individual trees was obtained by applying an established pantropical allometric equation using tree DBH and height as explaining variables (Chave et al., 2014). Since DBH was measured for all trees included in the forest inventories but height only for a subsample (around 60 per cent of all trees), a tree height model was developed to derive height estimates for all trees, as mentioned in paragraph 15 above. In response to an exchange during the TA, Bangladesh provided additional information on the development of its height model. Wood densities were derived from a global wood density database. On the basis of the thus obtained above-ground tree biomass estimate, below-ground biomass was derived using the IPCC default ratio of below-ground to above-ground biomass for tropical moist deciduous forests with above-ground biomass of <125 t ha^{-1}. In the current submission, Bangladesh did not consider the uncertainty introduced by the tree height model. The AT identified this as an area for improvement following the stepwise approach.

24. Bangladesh did not include the deadwood, litter and soil carbon pools. The Party presented supporting information indicating that the contribution of these pools to overall emissions and removals can be considered to be small. Bangladesh has plans to collect information in order to include it in future submissions. The AT commends the Party for these efforts.

25. Bangladesh estimated the uncertainty associated with AD and EFs. The uncertainty of AD was established on the basis of the accuracy assessment of the land classification. The uncertainty of EFs was derived on the basis of the assessment of above-ground biomass estimates of different land-cover types in individual polygons. The AT noted that the Party

may wish to consider providing additional information on its calculation of uncertainty. This may include the components of the above-ground biomass estimates that were included, such as model uncertainty (a methodology is provided in an article by Chave et al. (2014)), uncertainty in the height equation that was used to estimate tree height for trees with missing height information, and uncertainty in wood densities (although no uncertainty estimates are provided in the database that Bangladesh consulted). Furthermore, the estimate of below-ground biomass is associated with uncertainty, which is currently not considered. The uncertainty in the above-ground to below-ground ratio is provided in the 2006 IPCC Guidelines (vol. 4, table 4.4), which was used by the Party to obtain the ratio.

26. Bangladesh's submission is not fully consistent with its NC3. The Party adequately justified the discrepancies between the submission and the NC3 regarding the omission of the soil pool and the forest definition, stating that they were the result of using more current and comprehensive data, expected to have increased the accuracy of the submission.

27. The AT commends Bangladesh for an overall complete, transparent and consistent submission containing accurate estimates as far as possible and as permitted by current data. Areas for improvement identified by the Party in its submission and during the exchange with the AT can be addressed by Bangladesh in its work on updating and improving its future FREL/FRL submissions.

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

28. Bangladesh presented recently implemented and planned efforts to reduce deforestation and forest degradation, and to enhance forest resources in and outside forest land, including measures to reduce illegal harvesting and extensive fuelwood collection, social forestry programmes and coastal afforestation. The Party appended an extensive list of policy measures to the submission. It also presented the existing challenges and potential conflicts of interest with other sectors, such as plans to improve railway infrastructure that may negatively affect existing forest resources.

29. Bangladesh identified areas for potential technical improvement of its FRL that include aspects identified by the AT, such as including the deadwood, litter and soil pools, as well as additional opportunities such as the development of land-use or land-cover maps for additional points in time.

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

30. The pools included in the Party's FRL are above-ground and below-ground biomass. The omission of the deadwood, litter and soil pools was due to a lack of reliable national data.

31. The AT considers that the exclusion of the deadwood, litter and soil pools was adequately justified by Bangladesh. On the basis of limited available data and information from literature, carbon stocks in these pools are comparably low, particularly in the deadwood pool, as deadwood is collected from the forest as fuelwood and the significance of changes in these pools can be considered small. The AT commends Bangladesh for its efforts and intention to obtain better information on these pools with the aim of including them in the FRL in the future as part of the stepwise approach.

32. The omission of the soil carbon pool is inconsistent with the NC3, where soil carbon stock changes are considered. However, the estimates for the NC3 are based on agricultural soils and comprise only a small set of samples.

33. Owing to the generally low tree canopy cover, an extensive understorey layer consisting of herbs, shrubs and small trees can be expected, which could significantly affect emissions and removals, particularly in terms of afforestation. Information on whether and how such data can be obtained from the available forest inventories is not provided in the current submission. The AT notes that Bangladesh may wish to consider improving the documentation of the data used, and to collect additional data in order to enhance the transparency, completeness and accuracy of its FRL submission.

34. In this submission, Bangladesh included only CO_2. The exclusion of non-CO_2 gases is well justified as data are lacking or are unreliable. Nevertheless, the AT considers the

treatment of non-CO_2 gases as an area for future technical improvement to make the FRL more comprehensive.

35. The AT acknowledges that Bangladesh included the most significant activities (reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks) of the five activities identified in decision 1/CP.16, paragraph 70, in accordance with its national capabilities and circumstances.

36. On the basis of the information provided by the Party, the AT notes that emissions and removals from the conservation of forest carbon stocks and sustainable management of forests are implicitly accounted for in the current FRL. However, owing to a lack of clear definitions, emissions and removals cannot be uniquely associated with these two activities. The AT commends Bangladesh for its plans to include the activities conservation of forest carbon stocks and sustainable management of forests in future submissions as part of the stepwise approach.

4. Definition of forest

37. Bangladesh provided in its submission the definition of forest used in the construction of its FRL. The definition is different from the one that the Party uses for its national GHG inventory and for its reporting to the Food and Agriculture Organization of the United Nations for the Global Forest Resources Assessment. For the FRL submission Bangladesh modified the forest definition used in its NC3 and in its reporting to the Food and Agriculture Organization of the United Nations (i.e. minimum area of 0.5 ha, height of 5 m or more and at least 10 per cent canopy cover) in order to include mangrove forests dominated by *Ceriops decandra*. Since this tree species typically does not reach heights of more than 2 m but dominates extensive mangrove forest areas in the Sundarbans region, the criterion for tree height in the forest definition was modified to include *Ceriops decandra* with a minimum height of 2 m.

38. The AT commends Bangladesh for including forests dominated by *Ceriops decandra* in its FRL as it is likely to result in more accurate and comprehensive estimates. Because this species has different growth forms than typical pantropical species, the volume equation used by the Party may not be suitable for *Ceriops decandra*. The AT notes that the Party may wish to consider evaluating the suitability of the applied equation and/or to derive a species-specific equation as part of the stepwise approach to improve its FREL/FRL.

III. Conclusions

39. The information used by Bangladesh in constructing its FRL for reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks is sufficiently transparent and complete and in overall accordance with the guidelines for submissions of information on reference levels. During the TA and in this report, the AT provided the Party with suggestions for improving transparency and completeness (see paras. 11, 19, 22, 23, 33 and 38 above), which to a large extent have been addressed in the modified submission.

40. The AT acknowledges that Bangladesh included in its FRL the most significant activities, the most important forest types at the national level and the most significant pools in terms of emissions from forests. The AT considers that, in doing so, Bangladesh followed decision 1/CP.16, paragraph 70, on activities undertaken, and paragraph 71(b), on elaboration of a subnational FREL/FRL as an interim measure, and decision 12/CP.17, paragraph 10, on applying the stepwise approach. The AT commends Bangladesh for providing information on its ongoing and planned work to develop FRELs/FRLs for other activities as well as for other pools and gases.

41. As a result of the facilitative interactions with the AT during the TA, Bangladesh 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 used to construct the FRL, and commends Bangladesh on its efforts. The new information

provided in the modified submission, including examples of how estimates of CO_2 emissions from deforestation were calculated, increased the reproducibility of the FRL calculations.

42. The AT notes that, overall, the FRL maintains consistency, in terms of sources of AD and EFs, with the GHG inventory included in Bangladesh's NC3, with the justified exceptions described in paragraphs 32 and 38 above.[12]

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

(a) The description of the derivation of the land-cover change map could be improved (see paras. 14 and 16 above). This could be achieved by adding the information that was provided to the AT during the TA;

(b) The use of 50 per cent tree cover in 2000 as the threshold for deriving AD for forest degradation and enhancement of carbon stocks is not adequately justified (see para. 19 above). Adding additional information from, for example, the article by Potapov et al. (2017) that was cited in the submission could be provided. Furthermore, a map showing the tree cover percentage of areas of forest land (see para. 20 above) could be included in future submissions;

(c) Some strata of the land-cover change map are associated with high uncertainty (see para. 21 above). Uncertainty may be reduced by, for example, merging the strata of low- and high-intensity areas of forest degradation and enhancement of carbon stocks, respectively. In addition, an analysis based on the raster imagery directly rather than on converted vector data based on polygons could result in a reduction in uncertainty;

(d) The submission lacked details on the forest inventory information that was used to obtain the EFs (see para. 22 above). Additional information could be provided on, for example, how different designs were harmonized with respect to differences in DBH thresholds and plot sizes;

(e) The components of uncertainty in EFs are not described in the submission (see para. 25 above). The submission could profit from additional information on how the uncertainty of the volume and the height models, wood densities and above-ground to below-ground ratio were included in the uncertainty assessment of EFs;

(f) Bangladesh considered only the biomass of trees in its estimation of EFs, although non-tree vegetation in the understorey may contain significant biomass and carbon stores due to the comparatively open forest canopy (see para. 33 above). Information demonstrating that the volume of understorey biomass is small compared with tree biomass could be provided. Alternatively, the Party may wish to include the measurements of this vegetation layer in its national forest inventory to obtain estimates to improve the accuracy of EFs;

(g) As documented in the submission of Bangladesh, a large proportion of total above-ground tree biomass in Bangladesh is found within trees outside forests. Bangladesh does not currently consider this carbon pool as it does not meet the national forest definition. As these trees may present a large reservoir and capacity for carbon sequestration as documented in the submission, Bangladesh may wish to consider strategies to account for this pool;

(h) Bangladesh identified several areas for improvement in its submission. The Party may wish to consider providing additional details, for example on how these planned improvements can be implemented, and whether they are realistic with regard to available capacity and financial constraints.

44. 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 deadwood, litter and soil pools and the gases excluded by Bangladesh are likely to be insignificant in the context of the FRL. Nevertheless, pursuant to decision 13/CP.19, annex, paragraph 3, the AT identified the following additional

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

areas for future technical improvement regarding the exclusion of pools and gases from the FRL:

(a) Treatment of the deadwood, litter and soil carbon pools (i.e. the inclusion of the pool or the provision of more information justifying its omission) (see para. 31 above);

(b) Treatment of the soil carbon pool and consistency with the GHG inventory included in the Party's NC (see para. 32 above);

(c) Treatment of non-CO_2 gases (i.e. more information justifying their omission) (see para. 34 above).

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

(a) Include emissions and removals from the additional activities of conservation of forest carbon stocks and sustainable management of forests when relevant data are available;

(b) Carry out additional forest inventories;

(c) Collect data on the soil carbon pool;

(d) Improve and update AD.

46. In conclusion, the AT commends Bangladesh for showing strong commitment to the continuous improvement of its FRL estimates in line with the stepwise approach. A number of areas for the future technical improvement of Bangladesh'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.[13] The AT also acknowledges that the TA was an opportunity for a rich, open, facilitative and constructive technical exchange of information with Bangladesh.

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

[13] Per decision 13/CP.19, annex, para. 1(b), and decision 12/CP.17, para. 10.

Annex I

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

Main features of the FRL		*Remarks*
Proposed FRL	374 253 t CO_2 eq/year based on emissions of 1,188,971 t CO_2 eq/year and removals of –814 718 t CO_2 eq/year	The national FRL includes CO_2 emissions from deforestation and degradation and removals from forest enhancements (see paras. 7 and 9 of this document)
Type and reference period of FRL	FRL = average of historical emissions and removals in 2000–2015	See paragraph 7 of this document
Application of adjustment for national circumstances	No	
National/subnational	National	See paragraph 6 of this document
Activities included	Reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks	See paragraph 6 of this document
Pools included	Above-ground biomass and below-ground biomass	Bangladesh justified the exclusion of the deadwood, litter and soil carbon pools for all three activities because of a lack of information at the national level (see paras. 24, 30 and 31 of this document)
Gas included	CO_2	See paragraph 37 of this document
Forest definition	Land spanning more than 0.5 ha with trees higher than 5 m and a canopy cover of more than 10 per cent, or trees able to reach these thresholds in situ	For the construction of the FRL, the forest definition was modified to include mangroves that are considered as forests in the Sundarbans area. These are dominated by *Ceriops decandra*, which does not usually reach more than 2–2.5 m in height (see para. 37 of this document)
Consistency with latest GHG inventory	Methods used for estimating the FRL are not fully consistent with the latest GHG inventory (2018)	Bangladesh transparently provided the differences between the GHG inventory for its NC3 and the FRL. An update of the GHG inventory will be published with the Party's first biennial update report and NC4, which will be consistent with the FRL (see paras. 26, 32 and 37 of this document)
Description of relevant policies and plans	Included	Challenges to existing efforts and plans to reduce emissions from deforestation and forest degradation and to enhance carbon stocks are discussed in the context of national circumstances and

Main features of the FRL		*Remarks*
		policies of other sectors that may conflict with efforts (see para. 28 of this document)
Description of assumptions on future changes to domestic policies, if included in the construction of the FRL	Included	Bangladesh described some of the assumptions about future changes that may have an impact on domestic policies (see para. 28 of this document)
Description of changes to previous FRL	Not applicable	
Identification of future technical improvements	Included	Several areas for future technical improvement were identified (see paras. 43–44 of this document)

Annex II

Documents and information used during the technical assessment

A. Reference documents

Chave J, Réjou-Méchain M, Búrquez A, et al. 2014. Improved allometric models to estimate the aboveground biomass of tropical trees. *Global Change Biology*. 20(10): pp.3177–3190. Available at https://onlinelibrary.wiley.com/doi/abs/10.1111/gcb.12629.

First FRL submission of Bangladesh. Available at http://unfccc.int/8414.

"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.

Potapov P, Siddiqui B, Iqbal Z, et al. 2017. Comprehensive monitoring of Bangladesh tree cover inside and outside of forests, 2000–2014. *Environmental Research Letters*. 12(10): 104015. Available at https://iopscience.iop.org/article/10.1088/1748-9326/aa84bb/meta.

B. Additional information provided by the Party

The following documents[1] were provided by the Party in response to requests for clarification or additional information during the TA:

Costello L, Sola G, Iqbal Z, et al. Harmonization of sub-national forest inventories to improve national biomass estimates: a methodological approach in Bangladesh. Submitted to *Forest Ecology and Management*.

Latif Fakir M A, Netzer M, Haradhan B, Mohaiman Chowdhury R. 2015. Forest carbon inventory 2014 at Eight Protected Areas in Bangladesh – Main report. Forest Department and Winrock International.

[1] Reproduced as received from the Party.