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Report of the technical assessment of the proposed forest reference level of India submitted in 2018

Summary

This report covers the technical assessment of the submission of India, on a voluntary basis, 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 India covers the activity “sustainable management of forests”, which is among the activities included in decision 1/CP.16, paragraph 70. In its submission, India has developed a national FRL. The FRL presented in the original submission, for the reference period 2000–2008, corresponds to –49,700,000 tonnes of carbon dioxide equivalent per year. The assessment team notes that the data and information used by India in constructing its FRL are partially transparent and not 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, according to the scope of the technical assessment contained in the annex to decision 13/CP.19.

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I. Introduction and summary

A. Overview

1. This report covers the technical assessment (TA) of the submission of India on its proposed forest reference level (FRL),¹ submitted on 8 January 2018 in accordance with decisions 12/CP.17 and 13/CP.19. The TA took place (as a centralized activity) from 19 to 23 March 2018 in Bonn, Germany, and was coordinated by the UNFCCC secretariat.² The TA was conducted by two land use, land-use change and forestry experts from the UNFCCC roster of experts³ (hereinafter referred to as the assessment team (AT)): Ms. Thelma Krug (Brazil) and Mr. Raúl Abad Viñas (European Union). In addition, Mr. Thiago de Araújo Mendes, an expert from the Consultative Group of Experts on National Communications from Parties not included in Annex I to the Convention, participated as an observer⁴ during the centralized activity in Bonn. The TA was coordinated by Mr. Dirk Nemitz (UNFCCC secretariat).

2. In response to the invitation of the Conference of the Parties (COP) and in accordance with the provisions of decision 12/CP.17, paragraphs 7–15, and its annex, India submitted its proposed FRL on a voluntary basis. The proposed FRL is one of the elements⁵ to be developed in the implementation of the activities referred to in decision 1/CP.16, paragraph 70. The COP decided that each submission of a proposed FRL and/or forest reference emission level (FREL), as referred to in decision 12/CP.17, paragraph 13, shall be subject to a TA in the context of results-based payments, pursuant to decision 13/CP.19, paragraphs 1 and 2, and decision 14/CP.19, paragraphs 7 and 8.

3. India provided its submission in English. The submission is supported by eight annexes, which enhanced its transparency: timber production from recorded forest area in India during 2005–2010 (annex 1); potential production of timber from trees outside forest by State or union territory (annex 2); recorded forest area since 1987 (annex 3); annual fuelwood consumption (annex 4); adult cattle unit dependent on forests (annex 5); forest cover change matrix between 2000 and 2008 (annex 6); depiction of forest cover change and classified sample map of Telangana State (annex 7); and a bibliography (annex 8).

4. The objective of the TA was to assess the degree to which the information provided by India was in accordance with the guidelines for submissions of information on FRELs/FRLs⁶ 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 India for the construction and future improvement of its FRELs/FRLs, as appropriate.⁷

5. The TA of the FRL submitted by India was undertaken in accordance with the guidelines and procedures for the TA of submissions from Parties on proposed FRELs and/or FRLs as contained in the annex to decision 13/CP.19. This report on the TA was prepared by the AT following the guidelines and procedures in the same decision.

6. Following the process contained in those guidelines and procedures, a draft version of this report was communicated to the Government of India. The facilitative exchange during the TA allowed India to provide clarifications and additional information that were considered by the AT in the preparation of this report.⁸ As a result of the facilitative interactions with the AT during the TA, India provided a modified version of its FRL submission on 28 May 2018, which took into consideration some of the technical inputs of the AT. The modifications improved the clarity and transparency of the submitted FRL, but the approach and method used in the construction of the FRL were the same as in the original

¹ The submission of India is available at <http://unfccc.int/8414>.

² Decision 13/CP.19, annex, paragraph 7.

³ Decision 13/CP.19, paragraphs 7 and 9.

⁴ Decision 13/CP.19, paragraph 9.

⁵ Decision 1/CP.16, paragraph 71(b).

⁶ Decision 12/CP.17, annex.

⁷ Decision 13/CP.19, annex, paragraph 1(a) and (b).

⁸ Decision 13/CP.19, annex, paragraphs 1(b), 13 and 14.

submission. 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.⁹

B. Proposed forest reference level

7. The national FRL proposed by India for the activity “sustainable management of forests” is based on the average of the annual carbon stock increments associated with the net increase in forest area in tonnes of carbon dioxide equivalent (t CO₂ eq) per year in the historical period 2000–2008. The activity data (AD) used in the construction of the FRL were derived from the analysis of satellite imagery that provided forest cover information for 2000, 2004 and 2008.¹⁰ Emission factors (EFs) were obtained from India’s National Forest Inventory (NFI) and a study conducted by the Forest Survey of India (FSI) (of India’s Ministry of Environment, Forest and Climate Change) in 2008–2010.¹¹ The FRL presented in the modified submission (the same value as that reported in the original submission) with the aim of accessing results-based payments for REDD-plus¹² activities from 2008 to 2018 corresponds to –49,700,000 t CO₂ eq/year.

8. In decision 1/CP.16, paragraph 70, the COP encourages 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 the provision of adequate and predictable support. The FRL proposed by India, on a voluntary basis, for a TA in the context of results-based payments, covers the activity “sustainable management of forests”, which is one of the five activities included in decision 1/CP.16, paragraph 70. Pursuant to paragraph 71(b) of the same decision, India has developed a national FRL that covers its entire territory.

9. The proposed FRL includes all carbon pools (i.e. above-ground biomass, below-ground biomass, deadwood, litter and soil organic carbon). Regarding greenhouse gases (GHGs), the submission includes carbon dioxide (CO₂) only.

10. The annexes to the modified submission (see para. 3 above) were not subject to the TA, but provided useful information that helped to clarify some of the technical issues identified by the AT, thus increasing the transparency of the submission. In the modified submission, a new annex 7 containing a sample of a satellite image over Telangana State and the corresponding land-cover classification was included, and the originally submitted bibliography became annex 8.

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 that was used by the Party in the construction of the forest reference level

11. For the construction of the FRL, India used the methodology provided in the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance for Land Use*,

⁹ <http://unfccc.int/8414>.

¹⁰ The AD for 2000, 2004 and 2008 are provided in table 5 of the modified FRL submission.

¹¹ The study was conducted for the purpose of India’s second national communication and to supplement data not collected during the NFI (i.e. above-ground biomass of branches and foliage of trees with diameter at breast height of ≥10cm; above-ground biomass of trees with diameter at breast height of <10cm; above-ground biomass of shrubs, herbs, climbers and dead organic matter (deadwood and litter)).

¹² In decision 1/CP.16, paragraph 70, the COP encourages developing country Parties to contribute to mitigation actions in the forest sector by undertaking the following 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.

Land-Use Change and Forestry (hereinafter referred to as the IPCC good practice guidance for LULUCF) as the basis for estimating changes in carbon stock resulting from the sustainable management of forests. Accordingly, the net CO₂ removals from existing forests were estimated as the mean annual increment in carbon stocks, calculated for the period 2000–2008, by combining AD (i.e. annual area of forest in 2000, 2004 and 2008) and the appropriate EFs (i.e. carbon stocks associated with the corresponding forest type,¹³ density class and carbon pool).

12. The AD used in the construction of the FRL are based on land-cover data (i.e. forest cover maps) from the national forest monitoring system, which are based on the digital analysis of data (images) from optical sensors on board Indian satellites (LISS III, multispectral, 23.5 m spatial resolution¹⁴). Raw satellite data were geometrically rectified to generate a mosaic of images that was subsequently classified according to the density of forest cover using the Normalized Difference Vegetation Index: very dense forest, with canopy density of more than 70 per cent; moderately dense forest, with canopy density of between 40 and 70 per cent; and open forest, with canopy density of between 10 and 40 per cent. Scrubs, defined as areas with canopy density of less than 10 per cent, and non-forest areas were also classified but were not considered forest. The forest type mapping is based on satellite data for 2004.

13. During the TA, the AT sought clarification regarding the accuracy of the AD derived using the Normalized Difference Vegetation Index. The modified submission included a list of limitations inherent to remotely sensed data that could affect the accuracy of the forest cover maps, including forest areas covered by clouds and shadows, areas with ground dimensions below the resolution of the LISS III sensor, and vegetation with low chlorophyll or poor foliage. India mentioned in its submission that, despite the limitations, the classification accuracy was normally above 90 per cent, and it included in the submission, as an example, the error matrix prepared for the *India State of Forest Report 2013*,¹⁵ whose overall accuracy was 91.46 per cent based on 4,000 sample plots. The AT commends India for providing this information, which increased the transparency of the submission and facilitated a better understanding of the accuracy of the AD.

14. The wall-to-wall land-cover maps were produced by FSI and the resulting data published in the *India State of Forest Report 2013*. For the FRL, data from previous such reports were checked and used to correct misclassifications, and the corresponding forest cover maps revised accordingly. This led to corrections of the estimated forest areas by 3.37 per cent for 2000, 0.10 per cent for 2004 and 0.10 per cent for 2008. For 2008, the total forest cover area used in the construction of the FRL was 692,693 km², whereas for 2004 it was 690,827 km², of which approximately 13 per cent corresponded to very dense forest, 46 per cent to moderately dense forest and 41 per cent to open forest. For 2000, the total forest cover area used was 675,906 km², of which approximately 8 per cent corresponded to very dense forest, 54 per cent to moderately dense forest and 38 per cent to open forest. Overall, the forest area assessed for those three years corresponded to approximately 21 per cent of the total geographical area of the country.

15. The primary source of data used to derive the EFs for sustainable management of forests was the NFI, supplemented by data from the study referred to in paragraph 7 above.

¹³ The forest type mapping was a one-time exercise using satellite data from 2004. The forest area in 2004 that was also forest area in 2000 and 2008 was assumed to remain under the same forest type. The additional forest area in 2000 and 2008, if not plantation (information on plantations is based on ancillary information), was assigned a forest type based on the nearest available forest type conforming to the soil and rainfall. Fifteen forest types were defined: tropical wet evergreen forest – North East; tropical wet evergreen forest – Western Ghats; tropical semievergreen forest – North East; tropical semievergreen forest – eastern Deccan; tropical semievergreen forest – Western Ghats; tropical moist deciduous forest; littoral and swamp forest; tropical dry deciduous forest; tropical thorn forest; tropical, subtropical dry evergreen and broadleaved hill forest; subtropical pine forest; montane and moist temperate forest; subalpine and dry temperate forest; alpine scrub; and plantation/trees outside forest.

¹⁴ The minimum mapping unit applied for the mapping of the forest cover, based on interpretation of satellite data for 2000, 2004 and 2008, was 1 ha, at the scale 1:50,000.

¹⁵ Available at <http://fsi.nic.in/forest-report-2013>.

FSI conducted forest inventories from 2002 until 2008, collecting data at regular intervals (two years per cycle¹⁶) on sample forest plots distributed across the country in different physiographic and climatic zones. About 21,000 plots of 0.1 ha in size were sampled in the period 2000–2008 and 17,000 met the definition of forest used in the construction of the FRL.

16. Dasometric information at tree level and other measurements collected during the inventories were used to derive EFs. For trees with diameter of ≥ 10 cm, woody volume was calculated using dasometric information as input data to volume equations developed by FSI for various tree species. The volume equations calculate above-ground volume, which includes the volume of the main stem measured up to 10 cm in diameter and the volume of all branches with a diameter of 5 cm or more. Bark volume equations were also developed, using the specific gravity of bark, and the volume results converted into biomass. The carbon stored in the bark was estimated using the percentage carbon content of wood and included in the above-ground biomass. A study was launched to develop biomass equations¹⁷ for above-ground biomass of branches, foliage of trees with diameter at breast height of ≥ 10 cm, and biomass of trees with diameter at breast height of < 10 cm. Finally, carbon stocks in the above-ground biomass of shrubs, herbs, climbers and dead organic matter (i.e. woody litter and deadwood) were estimated using their recorded weights collected in subsamples. To convert the volume of trees with diameter of ≥ 10 cm into biomass, species-specific values of wood density for 239 species and carbon contents available for 73 species were used. In the absence of species-specific information, average values for known species were applied. The below-ground biomass was estimated using default values from the IPCC good practice guidance for LULUCF. With regard to soil organic carbon, information was based on samples from the NFI that were analysed in standard soil laboratories using the Walkley-Black method.¹⁸

17. Carbon stock per unit area was estimated separately for each carbon pool, density class and forest type. Total forest carbon stocks for 2000, 2004 and 2008 were estimated using geographic information systems. For each year, the forest cover map with the three density classes was overlaid on the forest type map, generating 45 forest strata. In a second step, the geographic information system layer containing the location of the sample plots measured during the NFI was superposed with the layer containing the forest strata in order to identify the stratum of each sample plot. The EF for each stratum was generated by averaging the carbon content per unit area (in t carbon/ha) of each carbon pool for the plots falling within the same stratum. The total forest carbon stocks for 2000, 2004 and 2008 were estimated by multiplying the EFs (i.e. t carbon/ha) by the AD for the corresponding years. The difference between the carbon stock values for 2000 and 2004 was divided by four to generate the mean annual increment carbon stock (refer to table 5 in the modified submission) for the period. The same process was carried out for the period 2004–2008. The eight mean annual values expressed in t carbon were multiplied by 44/12 to convert the results into t CO₂ eq for use in the construction of the FRL. The result obtained from dividing the difference between the carbon stocks in 2000 and 2008 by eight (years) is exactly the same.

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

Methodological information, including description of data sets, approaches and methods

18. India's FRL is based on the average of the annual increments in carbon stock during the period 2000–2008. The AD were derived from forest cover maps for three years (2000, 2004 and 2008), which were generated from the analysis of remotely sensed data. The EFs were estimated mainly from dasometric information collected during the NFI and complemented by information from a study (see paras. 12–16 above). During the TA, the AT sought clarification on a number of issues regarding the construction of the FRL, which were clarified in the modified submission. Additional information was provided by India in the

¹⁶ India clarified to the AT that, owing to the low number of plots per cycle, data from the three cycles were combined and treated as if from a single inventory covering eight years.

¹⁷ The biomass equations were published in 2011 and made available in chapter 8 ("Carbon stock in India's forests") of *India State of Forest Report 2017*. Available at <http://fsi.nic.in/forest-report-2017>.

¹⁸ As requested by the AT during the TA, India circulated a note on the estimation of soil organic carbon by MK Gupta that helped to clarify the method used.

main text of the submission and its annexes, as well as through supplementary data made available to the AT. The AT commends India for the inclusion of this information, which facilitated the assessment of the submission and increased its overall transparency.

19. Decision 13/CP.19, annex, paragraph 2(a), indicates that the TA of the proposed FRL should assess the extent to which the FRL maintains consistency with corresponding anthropogenic forest-related GHG emissions by sources and removals by sinks as reported in the national GHG inventory. The AT noted some differences in the reported forest-related changes in carbon stock between India's second national communication (NC2) and its FRL submission. In response to a request for clarification, India explained that, owing to better data and ground information, previous misclassifications in the AD were corrected, thus leading to the identified discrepancies. The AT commends India for providing this explanation and considers that it should be included in any future FRL submission to facilitate the assessment of consistency between the information included in the FRL and corresponding anthropogenic forest-related emissions reported in the national GHG inventory.

20. In assessing the extent to which the information used in the construction of the FRL is consistent with that submitted to other international organizations, the AT requested additional information from India, which was further clarified in the modified submission, particularly with regard to the treatment of mangroves. India explained that the definition of forest and the treatment of mangrove areas have been the same for all its submissions, including for the Food and Agriculture Organization of the United Nations Global Forest Resources Assessment (FRA) 2015, and that the only difference was driven by the need to reclassify areas¹⁹ as required for the FRA in the case of different definitions being used by the country. The additional information provided by India allowed the AT to conclude that the forest definition applied by India for its FRL is broadly consistent with those used for its reporting to other international organizations.

21. In assessing the completeness of India's FRL submission, the AT requested information on the underlying data used to derive EFs, along with information on AD, to allow the reconstruction of the FRL. During the TA, India provided the AT with information on (1) area by forest type and density class for 2000, 2004 and 2008, (2) species-specific gravity and carbon content values, (3) species-specific volumetric equations and (4) carbon stock values (in t carbon/ha) by carbon pool, forest type and density class. In addition, a sub-area of a satellite image and the corresponding classification (in JPG format) was provided, but without the corresponding classification legend. The AT appreciates the provision of this information, which facilitated a better understanding of the FRL submission and the information included in section 4 of the modified submission. During the TA, the AT mentioned to India that the wealth of information and data available in the country was not properly made available for the reproduction of the FRL and suggested that India either download the information to an external server or provide links to the relevant publications for easy and public access. India indicated in the modified submission that all relevant documents are publicly available, but no explicit information was provided on how to access the data and/or information. The AT considers that the absence of this information in the modified submission does not allow for the reconstruction of the FRL, thus compromising the completeness of the submission. Therefore, the AT considers that making this information publicly available would increase the reproducibility and completeness of the FRL and should be considered as an area for future technical improvement.

22. During the TA, the AT sought clarification as to how the FRL was constructed. The AT analysed the information provided in section 4 of the modified submission and understands that the FRL (-49.70 Mt CO₂ eq/year) is based on the average of the annual increments in carbon stock in India's forest during the period 2000–2008 (see paras. 7 and 17 above). During the TA, India clarified that the carbon stock values per unit area obtained from different inventory cycles were obtained for the same forest area, as required when using the stock difference method to estimate changes in carbon stocks between two periods

¹⁹ In reporting the area of tree cover outside forests, the area of tree cover falling between 0.5 ha and 1.0 ha as obtained from the NFI was estimated to be 1,335,000 ha, which constitutes about 15 per cent of the total and was reclassified as "other land with tree cover" for the purpose of the FRA 2015.

of time. However, owing to the low number of sample plots per cycle, data collected during the three inventory cycles carried out from 2002 to 2008 were combined, generating a single value of carbon stock/ha (disaggregated by carbon pool, forest type and density class) that was used in the construction of the FRL. The AT considers that the approach used by India to estimate the total carbon stock of the country's forests, based on multiplying a single value of carbon stock/ha by the different forest areas for three years, reflects only the increase (or decrease) in carbon stock associated with the net increase (or decrease) in forest areas that occurred between those years, and does not reflect a real carbon stock difference approach. Moreover, the AT is of the view that the activity "sustainable management of forests" relates to the reporting category forest land remaining forest land, as acknowledged in box 5 of a 2016 Global Forest Observations Initiative report.²⁰ In line with these findings, the AT provides India with the following two suggestions for technical improvement:

(a) Given that data from three different inventory cycles are available, even if derived from low-intensity sampling, consider only areas of forest in 2000 that remained forest in 2004 and 2008, and then, by comparing the total carbon stock in these areas at different times, calculate a FRL for the activity "sustainable management of forests";

(b) Estimate separately the carbon stock increments in new forest areas between 2000, 2004 and 2008 and report them under the activity "enhancement of forest carbon stocks".

Description of relevant policies and plans, as appropriate

23. As the proposed FRL is based entirely on historical data, no assumptions about future changes to domestic policies are included in the submission. Information on forest resources and a description of the current legal and policy frameworks in India is included in the submission as part of the description of national circumstances. Specifically, India included detailed information on legislation supporting forest conservation and the sustainable management of forests, including the preservation of the rights of local communities in relation to land and forest products.

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

24. According to decision 12/CP.17, annex, subparagraph (c), the reasons for omitting a pool and/or activity from the construction of the FRL should be provided, noting that significant pools and/or activities should not be excluded. India provided estimates of carbon stock for all carbon pools (see para. 9 above). The AT commends India for the significant efforts made to collect information on carbon stocks for each of the carbon pools, which increased the transparency of the submission.

25. In line with the assessment provided in paragraph 22 above, the AT considers that the methodological approach used by India to estimate the changes in carbon stock by carbon pool is not fully in line with the IPCC good practice guidance for LULUCF. Therefore, the AT is of the view that this is an area for future technical improvement. The AT notes that the carbon stock changes per unit area, for each carbon pool, were not estimated by subtracting the carbon stocks at two distinct times, as per the IPCC good practice guidance for LULUCF, because only a single value from three cycles of measurements was used to estimate the carbon stock values. Instead, the AT notes that carbon stock changes result from adding areas of new forest, which drives the construction of the FRL. Specifically, the AT considers that:

(a) With respect to the carbon pools living biomass, dead organic matter and litter, where carbon stocks are derived from a single carbon stock value obtained from three cycles of measurements in areas of existing forest, the calculation of carbon stock changes by comparing the total carbon stock by pool in 2000 and 2008 may lead to overestimation, as the carbon stock values may not be fully representative of the areas of new forest (i.e. the oldest tree would be eight years old) included in 2008;

²⁰ Global Forest Observations Initiative. 2016. *Integration of 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 2.0. Rome: Food and Agriculture Organization of the United Nations.

(b) With respect to soil organic carbon, the AT notes that a single value of carbon stock/ha in soils, derived from measurements in areas of existing forest, was used. Hence, when deriving carbon stock changes in soils between 2000 and 2008, India assumes that the carbon stock in the existing forest is reached by the new forest (the drivers of the change in carbon stock of the soils) in eight years, thus leading to an overestimation of the carbon sink in the soil organic carbon pool;

(c) In addition, as already stated during the TA, the AT notes that no information was provided on areas of organic soils, including in relation to the total forest area. Given the large amount of carbon stored in those soils, and their importance in terms of emissions when land-use changes or management practices enhance carbon oxidation, the AT considers that these areas should be separately delineated and their carbon stock changes individually estimated using specific EFs.

26. The AT noted that, while India's NC2 and biennial update report included non-CO₂ emissions due to fire occurrences on forest land, the FRL included only CO₂. During the TA, India explained that the biomass burning data available are not stable enough for inclusion in the FRL, and that they were included in its NC2 and biennial update report for the completeness of the inventory reporting. The AT considers the inclusion of non-CO₂ gases in the construction of the FRL as an area for future technical improvement, and suggests that, if non-CO₂ gases are not included in future FRLs, India provide a justification.

27. During the TA, India clarified that the activity "sustainable management of forests" includes not only afforestation as a management practice, but also harvesting (deforestation and forest degradation), thinning (forest degradation) and forest conservation. As stressed in the FRL submission, all these activities were significant and hence could not be ignored. This justified the election of sustainable management of forests as the most appropriate activity for India. The AT welcomes the explanations provided by India and considers that the transparency and accuracy of the FRL submission would be improved if the activities considered under sustainable management of forests (e.g. enhancement of forest carbon stocks, deforestation and harvesting) were reported separately, as the AT is of the view that the methodological approach currently applied by India does not properly capture the emissions and removals from all the activities considered.

28. The carbon stock values used in the construction of the FRL implicitly capture the conversion of forest to non-forest land (deforestation), the conversion of non-forest to forest land (afforestation/reforestation), forest degradation (assumed as changes from very dense forest to moderately dense forest and open forest, and from moderately dense forest to open forest) and the enhancement of forest carbon stocks (assumed as changes from open forest to moderately dense forest and very dense forest, and from moderately dense forest to very dense forest). The analysis of the land-cover change matrices for 2000–2004 and for 2004–2008²¹ provided an estimate of the net increase in forest land area that drives the carbon stock changes that are used in the construction of the FRL (i.e. 16,787 km² net area increase between 2000 and 2008), as well as estimates of the areas of each of the other REDD-plus activities that were not explicitly included in the FRL:

(a) Deforestation affected 18,118 km² and 32,207 km², respectively, in the periods 2000–2004 and 2004–2008;

(b) Forest degradation affected 16,814 km² and 21,736 km², respectively, in the periods 2000–2004 and 2004–2008;

(c) Enhancement of forest carbon stocks took place on 37,792 km² and 24,450 km², respectively, in the periods 2000–2004 and 2004–2008;

(d) Afforestation took place on 33,040 km² and 34,072 km², respectively, in the periods 2000–2004 and 2004–2008.

29. The AT welcomes India's provision of this information, which increased the transparency of the submission and allowed the AT to better understand the overall approach used in the construction of the FRL. However, as noted by India and the AT (see para. 20

²¹ As requested by the AT, India included in annex 6 to the modified submission the land-cover change matrix for the period 2004–2008.

above), some REDD-plus activities not explicitly considered in the FRL take place in significant areas and therefore it cannot be unequivocally claimed that significant activities were not excluded. Thus, the AT is of the view that, in order to allow a proper assessment of the significance of each activity included in the FRL, and therefore to ensure compliance with decision 12/CP.17, annex, subparagraph (c), specific and consistent definitions should be established and provided in the text along with information on the implementation of appropriate approaches for estimating carbon stock changes for each activity. The AT considers this an area for future technical improvement.

4. Definition of forest

30. India provided in its submission the definition of forest used in the construction of its FRL (minimum area of 1 ha and at least 10 per cent canopy cover, irrespective of land use and ownership). India includes all land that meets the forest thresholds, including tree crops, fruit orchards, bamboo and agroforestry plantations. In the modified submission, India clarified that the definition used for the FRL is the same as that used in the national GHG inventory and India's reporting for the FRA 2015.

31. During the TA, India explained that areas of orchard, bamboo and palm could not be delineated and therefore their area was unknown. However, these areas are included in the FRL if they meet the forest definition thresholds. In response to a request for clarification from the AT, India explained that the area of such vegetation, as included in table 4 of the modified submission, was estimated using ancillary information that was not fully complete, as some of the areas were not included in the information used. With respect to the estimation of carbon stock for such vegetation, India explained that specific dasometric information was collected during the NFI. The AT commends India for the explanation and the inclusion of this information in the modified submission. It understands that, because no specific areas can be assigned to the vegetation, the corresponding carbon stocks should be assumed as equal to those of their forest type and density class. The AT acknowledges that this is an acceptable interim solution, but considers that delineating separately the orchard, bamboo and palm areas would allow for a more accurate designation of their carbon stocks and that, therefore, this should be considered as an area for future technical improvement.

III. Conclusions

32. The information used by India in constructing its FRL for the activity "sustainable management of forests" is partially transparent and not complete and therefore not in overall accordance with the guidelines for submissions of information on FRELs/FRLs (as contained in the annex to decision 12/CP.17).

33. The AT acknowledges that India included in the FRL an activity that encompasses all forest-related changes at the national level and included all carbon pools.

34. As a result of the facilitative interactions with the AT during the TA, India provided a modified submission, which took into consideration most of the technical inputs of the AT. The AT notes that the transparency and completeness of information was improved significantly in the modified FRL submission and commends India for the significant efforts made in this regard. However, the AT still has concerns about the approach taken to construct the FRL, the value of which remained the same as in the original submission.

35. The AT notes that, broadly, the FRL maintains consistency, in terms of sources of AD and EFs, with the GHG inventory included in India's latest national communication and biennial update report.²²

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

²² In reference to the scope of the TA, decision 13/CP.19, annex, paragraph 2(a).

- (a) Providing publicly available information on the underlying data used to construct the FRL so as to ensure its reproducibility and allow an assessment of its completeness (see para. 20 above);
- (b) With respect to the approach to estimating carbon stock changes for the activity “sustainable management of forests” (see para. 22 above):
- (i) Using dasometric information from each NFI cycle to estimate the changes in carbon stock for different years, thus allowing for the appropriate comparison of the carbon stocks at different times, in line with the carbon stock difference method;
 - (ii) Increasing the sample intensity of the NFI cycles in order to reduce the uncertainty of the carbon stock estimation;
 - (iii) Estimating separately the annual increment in carbon stock by pool for the new forest areas in order to derive specific carbon stock values for them and reporting them under the activity “enhancement of forest carbon stocks”;
- (c) With regard to the pools and gases included in the FRL, distinguishing between changes in carbon stock for organic and mineral soils in forest areas (see para. 24 above);
- (d) Enhancing consistency between the FRL submission and the GHG inventory by using the same AD and by including estimations for the same non-CO₂ gases (see para. 26 above);
- (e) Reporting explicitly carbon stock changes for each of the REDD-plus activities that are currently included under sustainable management of forests to increase the transparency and accuracy of the FRL (see paras. 25–29 above);
- (f) Developing an improved national system for the collection of AD to allow a complete and individual assessment of areas of orchards, bamboos and palms, in line with the forest definition, thus allowing a more accurate estimation of carbon stocks (see para. 31 above).

37. In conclusion, the AT commends India for showing a strong commitment to the continuous improvement of its FRL estimates in line with the stepwise approach. A number of areas for future technical improvement of India’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 adequate and predictable support.²³ The AT also acknowledges that the assessment process was an opportunity for a rich, open, facilitative and constructive technical exchange of information with India.

38. The table contained in the annex summarizes the main characteristics of India’s proposed FRL.

²³ Decision 13/CP.19, annex, paragraph 1(b), and decision 12/CP.17, paragraph 10.

Annex

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

	<i>Main features of the FRL</i>	<i>Remarks</i>
Proposed FRL (in t CO ₂ eq/year)	49 700 000	The FRL is based on the annual average of the increase in carbon stocks (in t CO ₂ eq) in the national forest cover for the historical period 2000–2008 (see para.7 of this document)
Type and duration of FRL	FRL = historical removals for the period 2000–2008	See paragraph 7 of this document
Adjustment for national circumstances	No	–
National/subnational	National	–
Activities included	Sustainable management of forests	Includes afforestation as a management practice, harvesting (deforestation and forest degradation), thinning (forest degradation) and forest conservation as a management practice (see paras. 27–29 of this document)
Pools included	AB, BB, DW, L, S	See paragraph 25 of this document
Gases included	CO ₂	See paragraph 26 of this document
Forest definition	Included	Minimum area of 1 ha and at least 10 per cent canopy cover, irrespective of land use and ownership, including all land that meets the forest thresholds, including tree crops, fruit orchards, bamboo and agroforestry plantations (see paras. 30 and 31 of this document)
Relationship with latest GHG inventory	Methods used for the FRL are overall consistent with the latest GHG inventory, submitted in 2015 as part of the biennial update report	Non-CO ₂ gases were not included in the FRL owing to the variability of the available data, while they were included in the GHG inventory for completeness (see paras. 19 and 26 of this document)
Description of relevant policies and plans	Included	Included for information purposes (see para. 23 of this document)
Description of assumptions on future changes in policies	Not applicable	–
Descriptions of changes to previous FRL	Not applicable	–
Future improvements identified	Yes	Several areas for future technical improvement were identified (see paras. 36–38 of this document)

Abbreviations: AB = above-ground biomass, BB = below-ground biomass, DW = deadwood, FRL = forest reference level, GHG = greenhouse gas, L = litter, S = soils.