



Report on the technical assessment of the proposed forest reference emission level of Ethiopia submitted in 2016

Summary

This report covers the technical assessment of the submission of Ethiopia, on a voluntary basis, on its proposed forest reference emission level (FREL) and forest reference level (FRL), in accordance with decision 13/CP.19 and in the context of results-based payments. The FREL/FRL proposed by Ethiopia cover the activities “reducing emissions from deforestation” and “enhancement of forest carbon stocks”, which are among the activities included in decision 1/CP.16, paragraph 70. In its submission, Ethiopia has developed a national FREL/FRL. The assessment team notes that the data and information used by Ethiopia in constructing its FREL/FRL are mostly transparent and complete, and are in overall accordance with the guidelines contained in the annex to decision 12/CP.17. This report contains the assessed FREL/FRL and a few areas identified by the assessment team for future technical improvement, according to the scope of the technical assessment 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 Ethiopia on its proposed forest reference emission level (FREL) and forest reference level (FRL),¹ submitted on 4 January 2016 in accordance with decisions 12/CP.17 and 13/CP.19. The TA took place (as a centralized activity) from 14 to 18 March 2016 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)): Mr. Lucio Santos (Colombia) and Ms. Andrea Brandon (New Zealand). In addition, Mr. Kamel Djemouai, 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.

2. In response to the invitation by the Conference of the Parties (COP) and in accordance with the provisions of decision 12/CP.17, paragraphs 7–15, and its annex, Ethiopia submitted its proposed FREL/FRL on a voluntary basis. This proposed FREL/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 FREL/FRL, 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 decisions 13/CP.19, paragraphs 1 and 2, and 14/CP.19, paragraphs 7 and 8.

3. In its submission, Ethiopia emphasized that the submitted FREL/FRL does not prejudice or modify any of its nationally determined contributions or nationally appropriate mitigation actions pursuant to the Bali Action Plan.

4. The objective of this TA was to assess the degree to which information provided by Ethiopia was in accordance with the guidelines for submission of information on FRELs/FRLs⁶ and to offer a facilitative, non-intrusive, technical exchange of information on the construction of the FREL/FRL, with a view to supporting the capacity of Ethiopia for the construction and future improvement of FRELs/FRLs, as appropriate.⁷

5. The TA of the FREL/FRL submitted by Ethiopia 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 the guidelines and procedures in the same decision, a draft version of this report was communicated to the Government of Ethiopia. The facilitative exchange during the TA allowed Ethiopia to provide clarifications and 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 session, Ethiopia submitted a modified submission on 1 September 2016, which took into consideration the technical inputs by the AT. The modifications improved the accuracy, clarity and transparency of the submitted FREL/FRL. This TA report was prepared based on the context of the modified FREL/FRL submission. The modified submission that contains the assessed FREL/FRL and the original submission are available on the UNFCCC website.⁹

¹ The submission of Ethiopia can be found 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.

⁹ <http://unfccc.int/8414>.

B. Proposed forest reference emission level and forest reference level

7. The national FREL/FRL proposed by Ethiopia for the historical reference period 2000–2013 includes two REDD-plus¹⁰ activities: reducing emissions from deforestation, captured in its FREL; and the enhancement of forest carbon stocks, captured in its FRL. The FREL/FRL cover the entire national territory of Ethiopia, incorporating all forests in the country; they are valid for at least five years, but they may be improved or resubmitted more frequently. They will be revised periodically in order to incorporate new or improved data that may become available.

8. The FREL is the annual average of the carbon dioxide (CO₂) emissions associated with bias-corrected area estimates of deforestation (2000–2013), defined as the conversion of forest land to other land. Any transition below the thresholds of the forest definition is considered as deforestation. The FRL is the annual average of the CO₂ removals associated with bias-corrected area estimates of the enhancement of forest carbon stocks, defined as the conversion of other land to forest land or any transition above the thresholds of the forest definition. The FREL presented in the modified submission, with the aim of accessing results-based payments for REDD-plus activities, corresponds to emissions of 17,978,735 t CO₂ eq/year. The FRL presented in the modified submission corresponds to removals of 4,789,935 t CO₂ eq/year.

9. In its submission, Ethiopia applied a stepwise approach to its development of the FREL/FRL, in accordance with decision 12/CP.17, paragraph 10. The stepwise approach enables Parties to improve the FREL/FRL by incorporating better data, improved methodologies and, where appropriate, additional pools. Emission factors (EFs) are derived from a national forest and landscape inventory (NFI). The national activity data are derived from remote sensing used in combination with sample data from Google Earth observations to determine the spatial extent of forest and forest area change (resulting in area estimates of deforestation with a 95 per cent confidence interval: 1,193 ± 579 thousand ha (49 per cent of adjusted area). The area estimate with a 95 per cent confidence interval of the forest gain class is 246 ± 216 thousand ha (88 per cent of adjusted area).

10. The proposed FREL/FRL include the pools above-ground biomass, below-ground biomass and dead wood. The litter and soil pools are not included in either the FREL or the FRL. Some litter data have been collected but there is no available methodology yet for utilizing the data to estimate carbon for reporting this pool. Ethiopia has assessed existing information which indicates that low levels of carbon are stored in the litter pool and it is likely to be an insignificant pool for Ethiopia. Ethiopia acknowledged that the soil pool may be very large and variable, but owing to the difficulty in obtaining accurate data the pool is excluded from this submission.

11. Regarding greenhouse gases (GHGs), the submission includes CO₂ only. Non-CO₂ gases were estimated to be less than 0.2 per cent of the deforestation emissions and therefore insignificant.

¹⁰ 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.

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

1. Information that was used by the Party in the construction of the forest reference emission level and forest reference level

12. For the construction of the FREL/FRL, Ethiopia applied the Intergovernmental Panel on Climate Change (IPCC) 2006 IPCC Guidelines for National Greenhouse Gas Inventories (hereinafter referred to as the 2006 IPCC Guidelines).

13. Ethiopia's proposed FREL includes emissions from deforestation, defined as the conversion of forest land to other land. The FREL includes only the gross emissions from deforestation identified when land classified as forest land has transitioned to land that no longer meets Ethiopia's forest definition, including the transition of forest land to open woodland. It does not require evidence of direct human-induced land-use change to a non-forest land use. It excludes any subsequent emissions and removals from the deforested lands.

14. Ethiopia's proposed FRL is for the enhancement of forest carbon stocks, defined as the conversion of other land to forest land, including the restoration of degraded woodlands resulting in the land transitioning above the thresholds of the forest definition. Ethiopia interprets the enhancement of forest carbon stocks as any land cover transition above the thresholds of its forest definition after the year 2000. It does not require evidence of direct human-induced land-use change from a non-forest land use.

15. Forest change (both gain and loss) is detected through supervised classification using Landsat imagery. The training data set created by Ethiopia to develop the supervised classification is based on the Global Forest Change product (Hansen et al., 2013),¹¹ which is assessed and validated by visual assessment using high-resolution imagery. Sets of images were compiled controlling phenology and cloud cover for two periods (1997–2003 and 2010–2015) in order to complete a single best-pixel mosaic for each multi-temporal initial and final period; then the single mosaics were arranged into a multi-temporal stack for detection of change between the two periods. As described by Ethiopia, validated training points were used on a national scale to train and directly classify loss, gain and stable classes from the mosaicked Landsat images using the Random Forest classifier algorithm. Manual editing was implemented on the first semi-automated product by delineating false and missed changes to correct the change detection product. The forest change map has also been overlaid with a map of biomes to divide the forest loss, forest gain and forest cover estimates by biome.

16. EFs are obtained from Ethiopia's NFI. The NFI has a stratified sampling design based on agroecological zones, the land use/land cover map (WBISPP, 2004)¹² and the potential vegetation atlas of Ethiopia (Friis et al., 2010¹³). Ground plot data are collected in a nested plot design. One complete cycle of the NFI has been completed and analysed to produce national EFs.

¹¹ Hansen MC, Potapov PV, Moore R, Hancher M, Turubanova SA, Tuykavina A, Thau D, Stehman SV, Goetz SJ, Loveland TR, Kommareddy A, Egorov A, Chini L, Justice CO and Townshend JRG. 2013. *High-resolution global maps of 21st-century forest cover change*. Science. 342(6160): pp.850–853.

¹² Federal Democratic Republic of Ethiopia, Ministry of Agriculture. 2004. Wood Biomass Inventory and Strategic Planning Project. *A strategic plan for the sustainable development, conservation and management of the woody biomass resources: final report*.

¹³ Friis I, Demissew S and van Breugel P. 2010. *Atlas of the Potential Vegetation of Ethiopia*. The Royal Danish Academy of Sciences and Letters.

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

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

17. An accuracy assessment was carried out based on good practices for estimating area and assessing accuracy of land change as proposed by Olofsson et al. (2014).¹⁴ The activity data, referred to as bias-corrected change area estimates, consist of new estimated areas per class (forest loss, forest gain, stable forest and stable non-forest) resulting from the use of an error matrix, created to correct the area estimations for the map bias. Map classification errors were identified by collecting sample point data and the summarized results used to populate the error matrix. The sample data verify whether the map classification is correct or incorrect at the location of the sample points by visual interpretation of the point using high-resolution imagery or, when not available, by interpretation of Landsat imagery by remote sensing experts. During the TA, Ethiopia provided additional supporting material to explain the process and included it in its modified submission. The AT considers that the inclusion of this additional information in Ethiopia's submission increases its transparency. It commends Ethiopia for including this additional information.

18. Ethiopia then corrected for bias. For the forest loss class, user and producer accuracy are 24 per cent and 51 per cent, respectively, and, for the forest gain class, user and producer accuracy are 18 per cent and 68 per cent, respectively. The change map was overlaid with the map of Ethiopia's biomes and the gain and loss per biome was then corrected based on the accuracy assessment. The AT identified increasing the accuracy of both loss and gain area as an area for technical improvement in subsequent submissions from Ethiopia.

19. According to decision 4/CP.15, developing country Parties should provide estimates that are as far as possible accurate and that reduce uncertainties, taking into account national capabilities and capacities. In its resubmission, Ethiopia provided more detailed information to show the iterative process of improvement to increase the accuracy and robustness of the estimations of area changes. The AT acknowledges that this is part of the stepwise approach and commends Ethiopia for the effort of increasing the reference data and for the increase in user accuracy of forest loss estimation. During the TA, Ethiopia informed that it has begun work in three regions (Amhara, Tigray and Southern Nations, Nationalities, and Peoples' Region) by collecting additional reference points to enhance the national archive to improve the national classification accuracy. The national measurement, reporting and verifying unit will arrange a series of sessions in the remaining regions to collect more reference points to improve the national AD and to reduce uncertainties. The AT is of the view that the error matrix constructed by Ethiopia provides valuable information to assess which classes are easily confounded with each other; for example, scheduling additional sessions of visual interpretation by regional experts, even if an intensive and prolonged process, can be used to improve classification accuracy, following the good practice of reducing uncertainties as far as practicable. The AT commends Ethiopia for continuing to improve its AD and suggests this analysis as an area for future technical improvement.

20. One of the challenges with the methodologies applied is that the presence or absence of tree cover does not necessarily correspond to permanent forest loss (as it may be temporary loss of tree cover due to harvest or natural disturbance) or forest gain, and therefore auxiliary data are necessary. In particular, it is helpful to have information on the spatial extent of plantation forests that are subject to periodic harvesting or areas subject to natural disturbance events so that those areas are not necessarily considered deforested when identified as destocked, unless there has been evidence of a subsequent land-use change. Distinguishing areas where forest cover is lost temporarily due to natural disturbance from areas where forest cover loss is permanent is not the subject of improvement work and is therefore currently not scheduled. The AT considers that in future

¹⁴ Olofsson P, Foody GM, Herold M, Stehman SV and Woodcock CE and Wulder MA. 2014. Good practices for estimating area and assessing accuracy of land change. *Remote Sensing of Environment*. 148: pp.42–57.

submissions Ethiopia could provide information showing that these potential sources of error have been addressed and that the area of deforestation therefore has not been overestimated. In response to a question from the AT, Ethiopia advised that the first draft of its land use/land cover map will have data separating planted from natural forests. Ethiopia also advised that, while it has prepared a plantation forest map, this map is undergoing improvement and was not used in the current submission. The AT commends Ethiopia for continuing to work on improving its activity data, noting this as an area for future technical improvement.

21. In its submission, Ethiopia provided national forest loss and gain estimates by biome (i.e. table 10 and figure 9). During the TA, in response to questions raised by the AT requesting more disaggregated data, Ethiopia provided the activity data for the Oromia region and informed the AT that currently further disaggregation is not possible. The AT commends Ethiopia for providing the additional information and for continuing to work on improving its activity data, noting this as an area for future technical improvement.

22. To estimate emissions and removals from land converted to forest land, Ethiopia applied the removal of the full carbon stock in a single year. Ethiopia acknowledged that this method may overestimate removals corresponding to the early years of forest growth but noted that this may be compensated for by the time it takes to detect new forests. According to IPCC default factors, it looks improbable that the carbon density in biomes that have vegetation at the maximum age of 13 years (the historical forest change period) will have reached the full carbon stock as assumed in the submission. For example, the EF for the above-ground biomass pool for the dry afro-montane biome is 53.40 t C/ha, while the IPCC default for tropical dry forest at age 13 is 15.6 t C/ha. For the moist afro-montane biome, the EF for the above-ground biomass pool is 94.12 t C/ha, while the IPCC defaults for 13 year old forests are 22.75 t C/ha for tropical mountain systems and 35 t C/ha for tropical moist deciduous forests. To avoid the over or underestimation of emissions and removals, as far as possible, Ethiopia could consider using an EF for the FRL for the conversion of land to forest land as recommended by the 2006 IPCC Guidelines, that is, to apply annual change estimates. Ethiopia noted that the area of forest gain reported will include both natural regrowth and plantation forests and therefore the IPCC defaults may not be representative of the sequestration occurring on these lands. Ethiopia also noted that, owing to the nature of its forest types and the time it takes to be able to identify new forests of these types in satellite imagery, the use of EFs for 13 years could underestimate the stocks in these forests. The AT notes that a more appropriate EF could be derived from a subset of NFI data that represent in a more accurate manner the carbon stock change occurring in land converted to forest land. The AT notes this as an area for future technical improvement.

23. Ethiopia has designed and implemented an NFI that applies stratified, systematic sampling. In response to a question from the AT, Ethiopia provided the sampling distribution and intensity information for the strata and biomes. Ethiopia advised the AT that the strata were identified using agroecological zones, a potential vegetation map and forest cover data,¹⁵ also demonstrating that the strata and biomes are almost completely overlapping. Results were calculated by stratum and then weighted using an inclusion probability analysis within each stratum. The AT commends Ethiopia for providing this information and including it in its modified submission.

24. The EFs are based on the analysis of data collected from the NFI, but the NFI was established applying a different forest definition from the one that Ethiopia used for the FREL. Ethiopia reported that this was in order to better capture dry and lowland, moist vegetation as well as to improve the alignment with the minimum mapping unit. Areas previously classified as Ethiopia's dense woodland now meet the forest definition. These areas are under pressure from the expansion of commercial agricultural use. The change also means that highly degraded forest lands are now excluded from the forest definition. As the minimum height has been reduced (from 5 m to 2 m) and canopy cover increased (from 10 per cent to 20 per cent), EFs based on the NFI data could be biased as vegetation shorter than 5 m may not have been systematically sampled. In response to a question from

¹⁵ See footnote 12 above.

the AT, Ethiopia explained that the sampling intensity of the NFI was based on strata where forests potentially exist, not the canopy cover or forest height, and therefore the Combretum-Terminalia biome may have been undersampled. Ethiopia also advised that increasing sampling in one biome may introduce bias as all biomes will not be treated equally. In its modified submission, Ethiopia provided revised EFs and their uncertainties from the NFI results for each biome, which indicate that the EFs for the Combretum-Terminalia biome are reasonable and there is no need to supplement the existing NFI sampling frequency for that biome. The AT commends Ethiopia for providing this information and for continuing to work on improving its EFs.

25. At the time of the final resubmission, data from 539 accessible and surveyed sampling units out of a total of 631 were available and considered for analysis. The remaining 92 sample units have been assessed as inaccessible; therefore the first cycle of the NFI is complete. A total of 128 of the surveyed sample units contained forest. During the TA, Ethiopia advised the AT that a complementary regional inventory was under way in four regions, designed to increase the accuracy of the current EFs. The AT commends Ethiopia for completing the NFI and continuing to work on improving its EFs.

26. In response to a question from the AT on how the land use/land cover classes in the 2013 land use/land cover map relate to the NFI strata, Ethiopia provided a table showing the links between the land use/land cover map nomenclature with the NFI first-level field inventory class. The AT commends Ethiopia for providing this information and considers that such information would increase the transparency of any possible future revised FREL submission.

27. During the TA, Ethiopia completed its NFI data collection programme and was able to reanalyse the EFs in its final submission. The AT was also provided with the underlying data behind figures 13–17 from Ethiopia’s submission. The AT commends Ethiopia for providing this information and considers that such information would increase the transparency of any possible future revised FREL submission.

28. The default carbon fraction of 0.5 (from the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*) has been updated to 0.47 (from the 2006 IPCC Guidelines) for the calculations contained in the modified submission. The AT commends Ethiopia for continuing to improve its EFs.

29. In view of the references in decisions 12/CP.17 and 13/CP.19 to consistency with the GHG inventories, the AT compared the deforestation estimates used to calculate the FREL/FRL with the estimates used for forest and grassland conversion in the most recently published GHG inventory for Ethiopia, which at the time of the TA were those included in the second national communication. The AT found that the historical emission estimates associated with the FREL exceeded the forest and grassland estimates in the published GHG inventory. The AT also found that the GHG inventory published is not consistent with the FREL/FRL in respect of forest definition, allometric equations, EFs and activity data. Since the sources of activity data differ between the GHG inventory and the FREL/FRL submission, it seemed very unlikely that the values can be consistent, and the AT found insufficient information in the GHG inventory to assess the reasons for the differences. The AT did not consider this further because Ethiopia explained that future GHG inventory reporting in the biennial update report (BUR) will use the improved data and new forest definition and full consistency will be ensured with both the FREL and the FRL.

30. Ethiopia compares its NFI results with secondary data sources in order to validate the NFI results. Following a question raised by the AT, Ethiopia commented that these secondary data and information were obtained from various sources, some processed and other raw data, including MSc theses, PhD dissertations, research reports and grey literature, and were concentrated on patches of remaining forest ecosystems of each biome. The data were collected for different purposes and therefore collection methodologies and timescales differ. In its submission Ethiopia explained that this is because the sampling design is likely to have been intended to target specific vegetation types (e.g. primary and dense forest patches) or a specific geographical area, rather than a statistically valid design on a national scale. The AT commends Ethiopia’s effort to include comparisons with

secondary data; in the context of quality assurance procedures for data and estimates, it is good practice to apply verification techniques as cross checks with secondary sources, but care must be taken to ensure that the characteristics of the selected data are, in fact, comparable. As this is an area for future technical improvement, Ethiopia may assess the selection of a subset of the total secondary units as a way to get more comparable results for above-ground biomass. Following up on the technical exchange during the assessment week, Ethiopia provided a further comparison in its modified submission with the IPCC default values, showing substantial consistency with the NFI estimates. The AT commends this improvement in the quality assurance procedures.

31. The estimate of area deforested over the period 2000–2013 from the forest change detection process was 372,188 ha. The estimate of deforested area to correct the map bias was estimated at 1,192,559 ha with a confidence interval of 95 per cent, which indicates that the true value of deforestation is between 614,000 and 1,772,000 ha. In the case of forest gain, the area estimated from the forest change detection process was 39,960 ha and the adjusted area estimated at 246,063 ha with a confidence interval of 95 per cent, which indicates that the true value of forest gain is between 30,000 and 462,000 ha. During the TA, Ethiopia provided additional information on how the accuracy and adjusted areas were derived and on the methods used in its revised submission. Furthermore, Ethiopia has revised the mapped area estimates and the accuracy assessment sampling and has reported new area estimates in its modified submission. The AT commends Ethiopia for providing this information and considers that the additional information considerably increases the transparency of the submission. The uncertainties for the new area estimates have been reduced (from 83 to 49 per cent for forest loss and from 132 to 88 per cent for forest gain). The AT commends Ethiopia for its work on reducing uncertainties in the activity data used to develop both the FREL and the FRL, and notes that, while uncertainties have been considerably reduced, this remains a priority area for ongoing technical improvement, as suggested in paragraphs 17–19 above.

Description of relevant policies and plans, as appropriate

32. Information on relevant domestic policies and plans has been included as part of Ethiopia's submission. Two key strategies, the Second Growth and Transformation Plan and the Climate Resilient Green Economy strategy, prioritize the attainment of middle-income status by 2025 by taking action on low-carbon, resilient, green growth. Both strategies emphasize agriculture and forestry, with the goals of increasing forest expansion by 7 million ha and reducing deforestation by half by 2025.

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

33. According to decision 12/CP.17, annex, subparagraph (c), reasons for omitting a pool and/or activity from the construction of the FREL/FRL should be provided, noting that significant pools and/or activities should not be excluded.

34. The carbon pools reported in both the FREL and the FRL include above-ground biomass, below-ground biomass and dead wood. Litter and soil carbon were not included owing to a lack of information. Ethiopia explained during the TA that the NFI will generate data to potentially allow the inclusion of the litter pool, following additional method development. The AT commends Ethiopia for collecting the data and considers that this is likely to be the least significant of the missing pools. Further, Ethiopia indicated during the TA that improvement work is under way to obtain litter and soil organic carbon estimates for forest and deforested areas. During the TA, information was provided from one study that indicates that the carbon fraction in soil is between low and moderate. The AT considers that the exclusion of the soil organic carbon pool is adequately justified owing to the lack of information currently available to use, and commends Ethiopia for carrying out further work to enable the quantification of the two missing pools. The AT considers that soil organic carbon may be a significant source and notes its inclusion as an area for future technical improvement for the FREL/FRL.

35. Ethiopia did not include non-CO₂ emissions in its FREL since data on fires are not reliable enough for inclusion in the FREL. However, Ethiopia evaluated the significance of

non-CO₂ gases by calculating annual non-CO₂ emissions for a burned area of 100 ha (minimum burned forest area reported in 2008) of the lowest biomass forest (biome 1) and for a burned area of 800 ha (maximum burned forest area reported in 2006) of the highest biomass forest (biome 4). This calculation suggests that the contribution of non-CO₂ emissions to total forest-related emissions is in the range of 0.1–37,000 t CO₂ eq for carbon monoxide, 0.1–33,000 t CO₂ eq for methane and 0.03–11,000 t CO₂ eq for nitrous oxide. Therefore the contribution of non-CO₂ gases is estimated to be below 2 per cent of total annual emissions from forest land in Ethiopia. The AT commends this approach and considers the treatment of non-CO₂ gases as an area for future technical improvement to maintain consistency with the GHG inventory included in the national communication.

36. Among the five eligible activities identified in decision 1/CP.16, paragraph 70, in accordance with national capabilities and circumstances, Ethiopia has chosen reducing emissions from deforestation for the calculation of the FREL and enhancement of forest carbon stocks for the calculation of the FRL. Ethiopia acknowledged in its submission that forest degradation is considered a significant source of emissions, but, owing to the lack of accurate, reliable and consistent data on a national scale, forest degradation is currently omitted from its FREL/FRL. In response to a question raised by the AT on its intention of gradually including forest degradation starting from the first quarter of 2016, Ethiopia indicated that forest degradation is not yet defined and a preliminary literature review is still ongoing. In response to a further question from the AT, Ethiopia advised that it expects to have information from its land use/land cover map on plantation areas within the next two months. The AT commends Ethiopia for providing this information and continuing to work on improving its activity data. The information could be useful in identifying where natural forests are being converted to another vegetation type that meets the forest definition (e.g. planted forest or bamboo), this being a form of degradation. As degradation is a potentially significant activity, the AT considers its inclusion to be an area for future technical improvement. It notes that it would be useful to describe the work being undertaken, for example by providing preliminary results and a road map for inclusion as an annex to any future submission.

4. Definition of forest

37. Ethiopia provided in its submission the definition of forest used in the construction of the FREL/FRL (i.e. minimum area of 0.5 ha, height of 2 m or more and at least 20 per cent canopy cover). The definition, adopted in February 2015, differs from the one that the Party uses in both its national GHG inventory and its reporting to the Food and Agriculture Organization of the United Nations for the Global Forest Resources Assessments (i.e. minimum area of 0.5 ha, height of 5 m or more and at least 10 per cent canopy cover). The new definition enables the inclusion of the dense woodland areas that are under pressure from agricultural expansion and the exclusion of highly degraded forests, as well as increasing the minimum area to align with the minimum mapping unit. Ethiopia explained that future GHG inventory reporting in the BUR will use the improved data and new forest definition and full consistency will be ensured with both the FREL and the FRL.

III. Conclusions

38. The information used by Ethiopia in constructing its FREL/FRL for deforestation and enhancement of forest stocks is mostly transparent and complete and is in overall accordance with the guidelines for submission of information on FRELs/FRLs (as contained in the annex to decision 12/CP.17).

39. The AT acknowledges that Ethiopia included in the FREL/FRL the most significant activity and the most significant pools in terms of emissions from forests. The AT considers that Ethiopia followed decision 1/CP.16, paragraph 70, on activities undertaken, and decision 12/CP.17, paragraph 10, on implementing a stepwise approach. The AT commends Ethiopia for the information provided on the ongoing work on the development of FRELs/FRLs for other activities.

40. As a result of the facilitative interactions with the AT during the TA session, Ethiopia submitted a modified submission that took into consideration the technical inputs by the AT. The AT notes that the transparency and completeness of information improved significantly in the modified FREL/FRL submission, and commends Ethiopia for the efforts made.

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

(a) Using the results of the accuracy assessment to identify the uncertainties and bias sources in the activity data estimation and proposing an improvement plan to reduce the systematic bias and increase the accuracy of forest area losses and gains;

(b) Distinguishing temporary loss of tree cover from permanent forest loss;

(c) Applying an annual increment or method that does not overestimate removals to estimate carbon stock change from forest gain;

(d) In the case of applying verification techniques as cross checks with secondary sources, ensuring that the characteristics of the selected secondary data are comparable, as good practice in the quality assurance procedures;

(e) Including an estimation of emissions from forest degradation.

42. In assessing the pools and the gases included in the FREL/FRL, pursuant to decision 13/CP.19, annex, paragraph 2(f), the AT notes that the current omission of pools and gases is likely to be conservative in the context of the FREL/FRL. Nevertheless, the AT identified the following additional areas for future technical improvement:

(a) Treatment of emissions from litter (i.e. the inclusion of this pool or the provision of more information on the justification for its omission);

(b) Treatment of emissions from soil organic matter (i.e. the inclusion of this pool or the provision of more information on the justification for its omission);

(c) Treatment of non-CO₂ gases, to maintain consistency with the GHG inventory included in the national communication.

43. The AT acknowledges and welcomes the intention expressed by Ethiopia to conduct further research on forest degradation in order to assess whether the reduction of deforestation is leading to the displacement of emissions, and to include emissions from degradation in future FREL/FRL submissions when new, adequate data and better information become available.

44. In conclusion, the AT commends Ethiopia for showing a strong commitment to the continuous improvement of its FREL/FRL estimates, in line with the stepwise approach. A number of areas for future technical improvements of Ethiopia's FREL/FRL have been identified in this report. At the same time, the AT acknowledges that these improvements are subject to national capabilities and policies, and notes the importance of adequate and predictable support.¹⁶ The AT also acknowledges that the assessment process was an opportunity for a rich, open, facilitative and constructive technical exchange of information with Ethiopia.

¹⁶ 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 emission level and forest reference level based on the information provided by the Party

<i>Main features of the FREL/FRL</i>		<i>Remarks</i>
Proposed FREL (in t CO ₂ eq/year)	17 978 735	The FREL includes gross emissions from deforestation (i.e. those associated with forest loss) and excludes any subsequent emissions and removals from deforested areas (para. 13)
Proposed FRL (in t CO ₂ eq/year)	-4 789 935	The FRL is the annual average of the CO ₂ removals associated with adjusted estimates from the enhancement of forest carbon stocks, defined as the conversion of other land to forest land or any transition above the thresholds of the forest definition (para. 14)
Type and duration of FREL/FRL	FREL/FRL = annual average emissions/removals from carbon stocks between 2000 and 2013	Paragraph 8
Adjustment for national circumstances	No	–
National/subnational ^a	National	Paragraph 7
Activities included ^b	Deforestation	Ethiopia defines deforestation as the conversion of forest land to other land. Deforestation includes any transition below the forest definition thresholds, including the transition of forest land to open woodland
	Enhancement of forest carbon stocks	The enhancement of forest carbon stocks is defined as the conversion of other land to forest land and includes the restoration of degraded woodlands resulting in a transition above the thresholds in the forest definition
Pools included ^b	AB, BB, DW	For the reported pools, it is assumed that the carbon immediately after deforestation is zero. The litter pool and soil organic carbon pool are not included owing to a lack of accurate data (para. 34)
Gases included	CO ₂	Preliminary estimates of non-CO ₂ gases included for information purposes (para. 35)
Forest definition ^c	Included	Minimum tree crown cover of 20%; minimum land area of 0.5 ha; minimum tree height of 2 m (para. 37)
Relationship with latest GHG inventory	Methods used for FREL/FRL differ from latest GHG inventory (2012)	Differences in methods are due to more recent data and Intergovernmental Panel on Climate Change guidance used being for the FREL/FRL as compared with the GHG inventory. The GHG inventory in the first biennial update report is currently under preparation with an updated methodology (para. 29)
Description of relevant policies and plans ^d	Included	Brief summary information included for information purposes (para. 32)

<i>Main features of the FREL/FRL</i>	<i>Remarks</i>
Description of assumptions on future changes in policies ^d	Not applicable –
Descriptions of changes to previous FREL	Not applicable –
Future improvements identified	Yes A number of areas for future technical improvement were identified (paras. 41 and 42)

Abbreviations: AB = above-ground biomass, BB = below-ground biomass, DW = dead wood, FREL = forest reference emission level, FRL = forest reference level, GHG = greenhouse gas.

^a If subnational, comments should include information on the treatment of displacement of emissions.

^b In the case of omitted pools or activities, comments should include the justification provided by the country.

^c The forest definition should be summarized, and it should be stated if it differs from the definition used in the GHG inventory or in reporting to other international organizations.

^d May be relevant to the description of national circumstances, which is required in the case of adjustment.