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

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| *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/FRLproposed by Ethiopia covers 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/FRLare 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 further technical improvement, according to the scope of the technical assessment in the annex to decision 13/CP.19. |
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1. Introduction and summary
   1. 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]](#footnote-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 17 to 18 March 2016 in Bonn, Germany, and was coordinated by the UNFCCC secretariat.[[2]](#footnote-2) The TA was conducted by two land use, land-use change and forestryexperts from the UNFCCC roster of experts[[3]](#footnote-3) (hereinafter referred to as the assessment team (AT)): Lucio Santos (Columbia) and 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 observer[[4]](#footnote-4) 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 elements[[5]](#footnote-5) 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 aproposed 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 prejudge or modify any of Ethiopia’s 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 submissions of information on FRELs/FRLs[[6]](#footnote-6) 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]](#footnote-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 annex to decision 13/CP.19, 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]](#footnote-8)[As a result of the facilitative interactions with the AT during the TA session, Ethiopia submitted a modified version on [date 2016], which took into consideration the technical inputs by the AT. The modifications improved the clarity and transparency of the submitted FREL*[, without need to alter the approach used to construct the proposed FREL*]. This TA report was prepared based on the context of the modified FREL/FRL submission. The modified submission that contains the assessed FREL/FRLand the original submission are available on the UNFCCC website.[[9]](#footnote-9)]
   2. Proposed forest reference emission level and forest reference level
      * 1. The national FREL and FRL proposed by Ethiopia for the historical reference period 2000–2013 includes two REDD-plus[[10]](#footnote-10) activities, reducing emissions from deforestation (deforestation)captured in its FREL and the enhancement of forest stocks(afforestation) captured in its FRL.The FREL and FRL cover the entire national territory of Ethiopia incorporating all forests in the country, theyare valid for at least five yearsbut that they may be improved or resubmitted more frequentlyand will be revised periodically in order to incorporate new or improved data that may be available.
        2. The FREL is the annual average of the carbon dioxide (CO2) emissions associated with adjusted estimates of deforestation, defined asthe 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 averageof the carbon dioxide (CO2) removals associated with adjusted estimates of afforestation or the enhancement of forest carbon stocks, defined asthe conversion of other land to forest land or any transition above the thresholds of the forest definition. The FREL presented in the submission, with the aim of accessing results-based payments for REDD-plus activities, corresponds to emissions of 19,498,496 tonnes of carbon dioxide equivalent per year (t CO2 eq/year). The FRL presented in the submission corresponds to removals of-10,247,080.97 tonnes of carbon dioxide equivalent per year (t CO2 eq/year).
        3. In this submission, Ethiopia applies a step-wise approach to its development of the FREL/FRL, in accordance with decision 12/CP.17, paragraph 10. The step-wise approach enables Parties to improve the FREL and FRLby incorporating better data, improved methodologies and, where appropriate, additional pools. The national FREL/FRL is based on national activity data derived from remote sensing and estimated areas adjusted by a factor of 3.21 times for deforested area and 10.8 times for afforested areas fortaking into account the map bias. The area change by biome and interim emission factors are derived from the Oromia Region. Ethiopia intends to replace the Oromia Region biome and emission factors with national biome and emission factors based on the analysis of more extensive data.
        4. The proposed FREL and FRLinclude the pools above ground biomass, below ground biomass and deadwood.The litter and soil pools are not included in either the FREL or the FRL. Some litter data have been collected but these are not sufficient to enable the reporting of this pool. Ethiopia has assessed existing informationwhich indicates the litter pool is not a significant source of emissions, and is therefore omitted. Ethiopia acknowledges that the soil pool may be very large and variable, but due to the difficulty in obtaining accurate data the pool is excluded from this submission.
        5. Regarding greenhouse gases (GHGs), the submission includes CO2 only. Non-CO2gases were estimated to be less than 0.2% of the deforestation emissions and therefore insignificant.
2. Data, methodologies and procedures used in the construction of the proposed forest reference emission level [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

* + 1. Information that was used by the Party in the construction of the forest reference emission leveland forest reference level
       1. For the construction of the FREL/FRL, Ethiopia applied the*2006IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines) and the 2003 *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the GPG-LULUCF).
       2. Ethiopia’s proposed FREL includes emissions from deforestationdefined asthe conversion of forest land to other land. The FREL includes only the gross emissions from deforestation, identified whenland 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.It excludes any subsequent emissions and removals from the deforested lands.
       3. Ethiopia’s proposed FRL is for enhancement of forest carbon stocks, or afforestation, defined asthe 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 afforestation, defined as any land cover transition above the thresholds of its forest definition after the year 2000. The AT notes that this afforestation definition is not consistent with afforestation defined in the 2006 IPCC Guidelines as the direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land. Ethiopia also does not require evidence of the land being in a non-forest land use prior to afforestation being detected.
       4. Forest change (both gain and loss) is detected through supervised classification using Landsat imagery. The training dataset created by Ethiopia to develop the supervised classification is based on the Global Forest Change product (Hansen et al., 2013)[[11]](#footnote-11)which is carefully assessed and validated by visual assessment using higher resolution imagery. Sets of images were compiledcontrolling phenology and cloud coverfor two periods (1997–2003 and 2010–2015)in order to complete a single best pixelmosaic for each multiple temporal initial and final period time; then the single mosaics werearrangedinto amulti-temporal stack for detection of change between the two time periods.As described by Ethiopia, validated training points were used at the national scale to train and directly classify loss, gain and stable classes from the mosaicked Landsat images using the Random Forest (RF) classifier algorithm.Manual editing was implemented on the first semi-automated productby delineating false and missed changes using QGIS to correct the change detection product. Finally an accuracy assessment was carried out based on good practices for estimating area and assessing accuracy of land change as proposed by Olofssonet al.(2014).[[12]](#footnote-12)
       5. The activity data,referred to as adjusted change areas estimates,consist of new estimatedarea per class (forest loss, gain, stable forest and stable non-forest) resulting from the use of an error matrix,created to correctthe estimations for the mapbias.Map classification errors were identified by collecting sample point data and the summarized results used to populate the error matrix. The sample data verifies whether 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.
       6. Emission factors are obtained from Ethiopia’s NFI. The NFI has a stratified sampling design based on Agro ecological zones. Ground plot data are collected in a nested plot design. At the time of this submission, only the data for the Oromia Region had been collected and analysed. The current submission therefore applies interim emission factors and these will replaced with national emission factors over time, once the NFI has been completed and the data have been analysed.
    2. Transparency, completeness, consistency and accuracy of the information used in the construction of the forest reference emission level

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

* + - 1. Ethiopia has created a land use/land cover map for 2013, but this map has not been used to detect forest change. Original images are used to detect forest change between 2000 and 2013, as maps do not have sufficient accuracy to derive change. To estimate the area of deforestation and afforestation that occurred between 2000 and 2013, Ethiopia directly classifies loss, gain and stable classes (see paragraph 15–16).Ethiopia then adjusts for bias by performing an accuracy assessment of the classification using higher resolution imagery following accuracy assessment guidelines (Olofsson et al, 2014; FAO, 2016[[13]](#footnote-13)). For the forest loss class (deforestation) user’s and producer’s accuracy are 16% and 56% respectively and for the forest gain class (enhancement of forest carbon stocks) user’s and producer’s accuracy are 18% and 79% respectively. The change map is overlaid with the map of Ethiopia’s biomes and the gain and loss per biome is then adjusted based on the accuracy assessment.During the TA, Ethiopia provided additional supporting material to explain the process. The AT commends Ethiopia for providing this information and considers that including this additional information would considerably increase the transparency of future submissions.
      2. According to decision 4/CP.15 Countries should provide estimates that are as far as possible accurate and that reduce uncertainties, taking into account national capabilities and capacities.Ethiopia provides an error matrix of the forest change map 2000–2013 which shows user’s accuracy of 16% and 18% for both forest loss and forest gain classes respectively; and a producer’s accuracy of 56% and 79 % for forest loss and forest gain classes respectively.The AT noted that the error matrix constructed by Ethiopia provides not only the accuracy of the map, but enough information to assess which classes are easily confounded with each other, therefore it can also be used to improve classification accuracy, following the good practice of reducing uncertainties so far as practicable, instead of going directly to the procedures to adjust estimates of areas. The AT suggests this analysis as an area of technical improvement.
      3. One of the challenges with the methodologies applied is that the presence or absence of tree cover does not necessarily correspond to deforestation (as it may be temporary loss of tree cover due to harvest or natural disturbance) or afforestation, 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 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 submissions Ethiopia could provide information showing that these potential sources of error have been accounted for and that the area of deforestation therefore has not been over estimated. In response to a question from the AT, Ethiopia advised that currently, they are unable to separate planted from natural forests. Ethiopia also advised that the first draft of Land Use Land Cover map will have data separating planted from natural forests. The AT commends Ethiopia for continuing to work on improving its activity data and noting it as an area for future technical improvement.
      4. In its submission, Ethiopia provided national forest loss and gain estimates by biome. During the technical assessment, 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. The AT notes that the national change estimates by biome are based on the Oromia Region which is not representative of the entire country. The AT commends Ethiopia for continuing to work on improving its activity data, noting it as an area for future technical improvement.
      5. To estimate emissions and removals on land converted to forest land, Ethiopia applies the removal of the full carbon stock in a single year. Ethiopia acknowledges this method may over estimate removals corresponding to the early years of forest growth but 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 emission factor for the Above Ground Biomass (AGB) pool for the Dry Afromontane biome is 57.64 tC/ha while the IPCC default for Tropical dry forest at age 13 is 15.6 tC/ha. For the Moist Afromontane biome, the AGB pool is 101.88 tC/ha while the IPCC defaults for 13 year old forests are 22.75 tC/ha for tropical mountain systems and 35 tC/ha for tropical moist deciduous forests. To avoid the over/under estimation of emissions and removals, as far as possible, Ethiopia could consider using an EF for the Forest Reference Level for Afforestation as recommended by 2006 IPCC guidelines, that is to apply annual change estimates, or estimate an EF from a subset of NFI that represent in a more accurate manner the stock of carbon for biomes up to 13 years old. The AT notes this as an area for future technical improvement.
      6. Ethiopia has designed and implemented a national Forest and Landscape Inventory (NFI) that applies systematic sampling within five strata. 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 agro ecological zones, a potential vegetation map and forest cover data, also demonstrating that the strata and biomes are almost completely overlapping. Results were calculated by stratum, and by biome class within each stratum. Ethiopia provided the AT with a table demonstrating the overlap. The AT considers that including this information would increase transparency of any possible future revised FREL/FRL submission.
      7. 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 is using for the FREL. Ethiopia reports the reason is to better capture dry and lowland, moist vegetation as well as improving 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 highly degraded forest lands are now excluded from the forest definition. As the minimum height has been reduced (from 5m to 2m) and canopy cover increased (from 10% to 20%) EF’s based on the NFI data are likely to be biased as vegetation shorter than 5m may not have been systematically sampled. In response to a question by 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*-*Treminalia* biome may be under-sampled. Ethiopia also advised that increasing sampling in one biome may introduce bias as all biomes will not be treated equally, and that it is developing a map of uncertainty from the NFI results to evaluate the need to supplement the existing NFI sampling frequency. The AT commends Ethiopia for providing this information and considers that the additional information would increase the transparency of any future submission. The AT commends Ethiopia for continuing to work on improving its emission factors and notes it as an area for future technical improvement.
      8. In response to a question by the AT on the number of plots and sampling units that were available and taken into account for analysis at the time of the submission, Ethiopia explained that 191 of 222 SU that were allocated in the Oromia Region had been surveyed and were used to derive EF’s for the biomes. The AT considers this level of information would increase transparency of any possible future revised FREL/FRL submission.
      9. Ethiopia signalled its intent to revise its submission by replacing the Oromia Region emissions factors with national emission factors in the course of 2016. The AT considers that the current interim emission factors will not be completely representative and therefore commends Ethiopia for continuing to work on updating and improving the emission factors noting it as an area for future technical improvement.
      10. In response to a question by the AT on how the land use/land cover classes in the 2013 LULC Map relate to the NFI strata, Ethiopia provided a table showing the links between the LULC Map nomenclature with the NFI first level field inventory class. During the assessment, the AT was also provided with the underlying data behind figures 9-13 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.
      11. The carbon fraction of 0.5 that has been applied is the default from GPG-LULUCF. The AT notes that default carbon fractions for above ground biomass have been updated in the 2006 IPCC Guidelines, noting this is an area for future technical improvement.
      12. Owing to 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 inventories 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 inventories. The TA found that GHG inventory published is not consistent with the FREL/FRL in respect of forest definition, allometric equations, emission factors and activity data. Since the sources of activity data are different 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 inventories 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.
      13. Ethiopia comparesits NFI results with secondary data sources in order to validate the NFI results. Following a question raised by the AT, Ethiopia commented that this secondary data and information was obtained from various sources, some processed and other raw data, including MSc theses, PhD dissertations, research reports and grey literature,and was concentrated on patches of remaining forest ecosystems of each biome. The data were collected for different purposes, therefore collection methodologies and time scales differ. The AT commendsEthiopia’s effort to include comparisons with secondary data; in the context of quality assurance procedures of data and estimates, it is good practice to applying 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. In the case of Ethiopia, it seems that primary data are not really comparable with secondary sources, as the secondary sources are potentially biased. This is because the sampling designis more likely to have been intended to targetspecific vegetation types (e.g. primary and dense forest patches), or a specific geographical area, rather than a statistically valid design at the national scale. Ethiopia could improve the quality assurance procedures in any possible future revised submissions by including comparisons with global data/international programmes and by selecting a subset of the total secondary units as a way to get more comparable results for above ground biomass (AGB). The AT notes this as an area for future technical improvement.
      14. The estimate of area deforested over the period 2000–2013 from the forest change detection process was 343,414 ha.The adjusted estimate of deforested area to correct the map bias was estimated as 1,103,472 ha with a confidence interval of 95% that ensures that the true value of deforestation is between 189,997 ha and 2,016,947 ha.In the case of afforestation, the area estimated from the forest change detection process was 40,578 ha and the adjusted area estimated as 438,341 ha with a confidence interval of 95% that ensures that the true value of afforestation is between -141,286 ha and 1,017,968 ha.In the view of the AT, such difference between the estimated areas in the map and the adjusted estimate areas, and the fact that adjusted estimate areas do not provide spatially explicit results that therefore do not allow for tracking afforestation and reforestationactivities within the territory of the country, along with estimating emissions and removals relevant to them, may lead either to an overestimation of emissions or underestimation of removals during the historical period. Harvested lands may be accounted as deforested areas, increasing the emissions during the historical period, and the same portion of land may be accounted as enhancement of carbon stocks during the period of implementation of activities. The AT notes the 95% confidence intervals for the adjusted estimates are very high. In response to a question raised by the AT, Ethiopia provided additional information to explain how the adjustments were calculated. The AT notes that the sampling design following Olofsson et al 2014 was to sample 903 points. 25% of points were not able to be sampled. It is good practice to address the impacts on how well the sample represents the population. The AT commends Ethiopia for providing this information and considers the additional information considerably increases the transparency of the submission. The method applied to adjust the forest change estimates following accuracy assessment results in estimates with large uncertainties (83% for deforestation and 132% for afforestation). The AT considers reducing uncertainties in the activity data used to develop both FREL and FRL a priority area for technical improvement.

Description of relevant policies and plans, as appropriate

* + - 1. Information on relevant domestic policies and plans has been included as part of Ethiopia’ssubmission. Two key strategies, the Second Growth and Transformation Plan (GTP-2) and the Climate Resilient Green Economy (CRGE) strategyprioritise attainment of middle income status by 2025 by taking low carbon, resilient, green growth actions. Both strategies emphasise agriculture and forestry, with goals to increase forest expansion by seven million hectares and reduce deforestation by half by 2025.
    1. Pools, gases and activities included in the construction of the forest reference emission level
       1. According to decision 12/CP.17, subparagraph (c) of the annex, reasons for omitting a pool and/or activity from the construction of the FREL/FRLshould be provided, noting that significant pools and/or activities should not be excluded.
       2. The carbon pools reported in both the FREL and the FRLincludeabove ground biomass, below ground biomass and dead wood. Litter and soil carbon pools were not included due to a lack of information. Ethiopia clarified 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 pool. Ethiopia clarified during the TA that no improvement work is underway to obtain soil organic carbon estimates. During the TA information was provided from one study that indicates the carbon fraction in soil is between low and moderate. The AT considers that the exclusion of soil organic carbon pool is adequately justified due to the lack of information currently available to use, that it may be a significant source and notesit as an area for future technical improvement for the FREL and FRL.
       3. Ethiopia does not include non-CO2 emissions in its FREL and FRL since data on of fires is not reliable 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 100ha (minimum burned forest area reported in 2008) of the lowest biomass forest (biome 1) and for a burned area of 800ha (maximum burned forest area reported in 2006) of the highest biomass forest (biome 4). This calculation suggests the contribution of non-CO2gas emissions to total forest-related emissions is in the range of 0.1–37,000 tCO2eq for CO, 0.1–33,000 tCO2eq for CH4 and 0.03–11,000 tCO2eq for N2O. 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 gasesas an area for future technical improvement to maintain consistency with the GHG inventory included in the national communication.
       4. Among the five eligible activities identified in paragraph 70 of decision 1/CP.16, in accordance with national capabilities and circumstances, Ethiopiahas chosen reducing emissions from deforestationfor the calculation of theFREL and enhancement of forest carbon stocks, defined as the conversion of other land to forest land, for the calculation of the FRL. Ethiopia acknowledges in its submission that forest degradation is considered a significant source of emissions, but due to the lack of accurate, reliable and consistent data at the 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 accounting for forest degradation starting from the first quarter of 2016, Ethiopia indicated that forest degradation is not yet defined and preliminary literature review is still ongoing. In response to a 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.This 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 it an area of technical improvement, and that it would be useful to describe the work being undertaken, e.g. by providing preliminary results and a road map for inclusion as an annex in any future modified submission.
    2. Definition of forest
       1. Ethiopia provided in its submission the definition of forest used in the construction of the FREL and FRL (i.e minimum area of 0.5ha, height of 2m 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 FAO FRA (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 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 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.

1. Conclusions
   * + 1. 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).
       2. 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. In doing so, 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 step-wise approach. The AT commends Ethiopia for the information provided on the ongoing work into the development of FRELs/FRLs for other activities.
       3. [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/FRLsubmission, [without the need to alter the approach or values used to construct the FREL,] and commends Ethiopia for the efforts made. The new information provided in the modified submission, [including through the data made available on websites[[14]](#footnote-14) and the examples on how estimates of CO2 emissions from deforestation were calculated,] increased the reproducibility of FREL/FRL calculations.]
       4. Pursuant to paragraph 3 of the annex to decision 13/CP.19, the AT identified the following areas for future technical improvement:
          1. Reducing uncertainties in estimating areas of deforestation and afforestation;
          2. Distinguishing temporary loss of tree cover from deforestation activities;
          3. Applying an annual increment or method that does not over estimate removals to estimate carbon stock change from afforestation activities;
          4. Ensuring change estimates for biomes are based on national data rather than the changes that occurred in the Oromia Region only;
          5. Replacing emission factors based on the Oromia Region with national emission factors;
          6. Updating carbon fractions to align with the 2006 IPCC Guidelines;
          7. Updating the NFI if necessary due to the change in forest definition to ensure emission factors are not biased;
          8. Improving secondary data sources for validating NFI results and quality assurance;
          9. Estimation of emissions from forest degradation.
       5. In assessing the pools and the gases included in the FREL/FRL, pursuant to paragraph 2(f) of the annex to decision 13/CP.19, the AT notes that the current omissions 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:
          1. Treatment of emissions from litter(i.e. the inclusion of this pool or the provision of more information on the justification of its omission);
          2. Treatment of emissions from soil organic matter (i.e. the inclusion of this pool or the provision of more information on the justification of its omission);
          3. Treatment of non-CO2 gases, to maintain consistency with the GHG inventory included in the national communication.
       6. The AT acknowledges and welcomes the intention expressed by Ethiopia to:
          1. Research 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/FRLsubmissions when new, adequate data and better information become available;
       7. In conclusion, the AT commends Ethiopia for showing a strong commitment to continuous improvement of its FREL/FRLestimates, in line with the step-wise approach. A number of areas for future technical improvements of Ethiopia’s FREL/FRLhave 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.[[15]](#footnote-15) The AT also acknowledges that the assessment process was an opportunity for a rich, open, facilitative and constructive technical exchange of information with Ethiopia.

Annex

**Summary of main features of the FREL/FRL proposed, based on the information provided by the country**

| *Main features of the FREL/FRL* | | *Remarks* |
| --- | --- | --- |
|  |  |  |
| Proposed FREL  (in t CO2eq/yr) | 19 498 496 | 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. 8) |
| Proposed FRL  (in t CO2eq/yr) | -10,247,080.97 | The FRL is the annual average of the CO2 removals associated with adjusted estimates of afforestation or the enhancement of forest carbon stocks, defined asthe conversion of other land to forest land or any transition above the thresholds of the forest definition.(para. 8) |
| Type and duration of FREL | FREL = historical emissions 2000–2013 | Estimates of deforestation for 1990–2013 reported for information purposes (para. 7) |
| Adjustment for national circumstances | No | - |
| National/subnational*a* | National | Paragraph 9 |
| 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 (Afforestation) | Afforestation is defined as the conversion of other land to forest land. Afforestation 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 is not included due to a lack of accurate data (para. 10) |
| Gases included | CO2 | Preliminary estimates of non-CO2 gases included for information purposes (para. 35) |
| Forest definition*c* | Included | Minimum tree crown cover of 20 per cent; minimum land area of 0.5 ha; minimum tree height of 2 m (para. 37) |
| Relationship with latest GHG inventory | Methods used for FREL differ from latest GHG inventory (2012) | Differences in methods are due to more recent data and Intergovernmental Panel on Climate Change guidance used in the FREL as compared to 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) |
| Description of assumptions on future changes in policies*d* | Not applicable | - |
| Descriptions of changes to previous FREL | Not applicable | - |
| Future improvements identified | Yes | Several areas for future technical improvements were identified (paras. 41-43) |

*Abbreviations*: AB = aboveground biomass, BB = belowground biomass, DW = dead wood, FREL = Forest reference emission level, GHG = greenhouse gas,L = litter, t CO2eq/yr = tonnes of carbon dioxide equivalent per year.

*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 greenhouse gas 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.

1. The submission of Ethiopia can be found at <<http://unfccc.int/8414>>. [↑](#footnote-ref-1)
2. Decision 13/CP.19, annex, paragraph 7. [↑](#footnote-ref-2)
3. Decision 13/CP.19, paragraphs 7 and 9. [↑](#footnote-ref-3)
4. Decision 13/CP.19, paragraph 9. [↑](#footnote-ref-4)
5. Decision 1/CP.16, paragraph 71(b). [↑](#footnote-ref-5)
6. Decision 12/CP.17, annex. [↑](#footnote-ref-6)
7. Decision 13/CP.19, annex, paragraph 1(a) and (b). [↑](#footnote-ref-7)
8. Decision 13/CP.19, annex, paragraphs 1(b), 13 and 14. [↑](#footnote-ref-8)
9. <http://unfccc.int/8414>. [↑](#footnote-ref-9)
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. [↑](#footnote-ref-10)
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 Townshen JRG. 2013.High-resolution global maps of 21st-century forest cover change. *Science*. 342: pp.850–853. [↑](#footnote-ref-11)
12. Olofsson, P., Foody, G. M., Stehman, S. V., & Woodcock, C. E. 2014. Good practices for estimating area and assessing accuracy of land change.Remote Sensing of Environment, 148, 42-57. [↑](#footnote-ref-12)
13. FAO. 2016. Map Accuracy Assessment and Area Estimation: A Practical Guide. Food and Agriculture Organization of the United Nations Rome 2016. [↑](#footnote-ref-13)
14. See the modified FREL submission for the websites referred to by Brazil. [↑](#footnote-ref-14)
15. Decision 13/CP.19, annex, paragraph 1(b), and decision 12/CP.17, paragraph 10. [↑](#footnote-ref-15)