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Report of the technical assessment of the proposed forest reference emission level of Uganda submitted in 2017

Summary

This report covers the technical assessment of the submission of Uganda, on a voluntary basis, on its proposed forest reference emission level (FREL), in accordance with decision 13/CP.19 and in the context of results-based payments. The FREL proposed by Uganda covers the activity “reducing emissions from deforestation”, which is among the activities included in decision 1/CP.16, paragraph 70. In its submission, Uganda has developed a national FREL. The FREL presented in the submission, for the reference period 2000–2015, corresponds to 8,047,420 tonnes of carbon dioxide equivalent per year (t CO₂ eq/year). As a result of the facilitative process during the technical assessment, the FREL was modified to 8,254,691 t CO₂ eq/year. The assessment team notes that the data and information used by Uganda in constructing its FREL are transparent, complete and in overall accordance with the guidelines contained in the annex to decision 12/CP.17. This report contains the assessed FREL 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 Uganda on its proposed forest reference emission level (FREL),¹ submitted on 16 January 2017 in accordance with decisions 12/CP.17 and 13/CP.19. The TA took place (as a centralized activity) from 13 to 17 March 2017 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. Manuel Estrada (Mexico) and Mr. Iordanis Tzamtzis (Greece). In addition, Mr. Brian Mantlana, 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 by the Conference of the Parties (COP) and in accordance with the provisions of decision 12/CP.17, paragraphs 7–15, and its annex, Uganda submitted its proposed FREL on a voluntary basis. The proposed FREL 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, 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. In its submission, Uganda stated its intention to use the stepwise approach to developing its national FREL and/or forest reference level (FRL) in accordance with decision 12/CP.19, paragraph 10, and the modalities for FRELS/FRLs contained in the same and other REDD-plus⁶ decisions, including the right to make adjustments to proposed FRELS/FRLs on the basis of national circumstances. Uganda also stated that it is seeking to coordinate its FREL submission with its other submissions (e.g. nationally appropriate mitigation actions, nationally determined contribution, national communications, biennial update reports and any that might be made in the future) and requested that the FREL submission not be seen to prejudice them.

4. The objective of the TA was to assess the degree to which information provided by Uganda was in accordance with the guidelines for submissions of information on FRELS/FRLs⁷ and to offer a facilitative, non-intrusive, technical exchange of information on the construction of the FREL with a view to supporting the capacity of Uganda for the construction and future improvement of its FRELS/FRLs, as appropriate.⁸

5. The TA of the FREL submitted by Uganda was undertaken in accordance with the guidelines and procedures for the TA of submissions from Parties on proposed FRELS and/or

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

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

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

⁴ Decision 13/CP.19, annex, paragraph 9.

⁵ Decision 1/CP.16, paragraph 71(b).

⁶ In decision 1/CP.16, paragraph 70, the COP encourages developing country Parties to contribute to mitigation activities 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 forest; and enhancement of forest carbon stocks.

⁷ Decision 12/CP.17, annex.

⁸ Decision 13/CP.19, annex, paragraph 1(a) and (b).

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 Uganda. The facilitative exchange during the TA allowed Uganda to provide clarifications and information that were considered by the AT in the preparation of this report.⁹ As a result of the facilitative interactions with the AT during the TA session, Uganda submitted a modified version of its FREL submission on 30 April 2018, which took into consideration the technical input of the AT. The modifications improved the clarity and transparency of the submitted FREL. This TA report was prepared in the context of the modified FREL submission. The modified submission, which contains the assessed FREL, and the original submission are available on the UNFCCC website.¹⁰

B. Proposed forest reference emission level

7. The FREL proposed by Uganda for the historical reference period 2000–2015 covers the entire national territory, with updates anticipated whenever improved data are available. The FREL is based on the annual average of historical carbon dioxide (CO₂) emissions associated with deforestation, defined as the conversion of forest to non-forest. The FREL includes only gross emissions from deforestation as a result of the conversion of forests and excludes any subsequent emissions and removals from the deforested areas. Activity data were derived from national land-use and land-cover maps produced for different years, namely 1990, 2000, 2005, 2010 and 2015, and bias-corrected area estimation approaches were used. Information on emission factors was obtained from historical data sets, such as the country's exploratory inventories, permanent sample plots (PSPs) and a national biomass study, filtered to exclude data falling outside of the FREL reference period. The FREL submitted by Uganda in the modified submission corresponds to 8,254,691 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 FREL proposed by Uganda, on a voluntary basis, for a TA in the context of results-based payments, covers the activity "reducing emissions from deforestation", which is one of the five activities included in decision 1/CP.16, paragraph 70. Pursuant to paragraph 71(b) of the same decision, Uganda has developed a national FREL for its entire national territory. In its submission, Uganda applies a stepwise approach to the development of the FREL, in accordance with decision 12/CP.17, paragraph 10. The stepwise approach enables Parties to improve their FRELs/FRLs by incorporating better data, improved methodologies and, where appropriate, additional pools.

9. The proposed FREL includes the pools above- and below-ground biomass. Regarding greenhouse gases (GHGs), the submission includes only CO₂.

⁹ Decision 13/CP.19, annex, paragraphs 1(b), 13 and 14.

¹⁰ <http://unfccc.int/8414>.

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

10. For the construction of the FREL, Uganda used methodologies consistent with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF) and the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines) as a basis for estimating changes in carbon stock in living biomass resulting from conversion of forest land to other land uses. Accordingly, the gross emissions from deforestation were estimated for the period 2000–2015 by combining activity data (i.e. areas of annual gross deforestation) with appropriate emission factors (i.e. CO₂ emissions associated with the corresponding vegetation groups).

11. The national FREL proposed by Uganda is for the activity “reducing emissions from deforestation”, with deforestation defined as the conversion of forest to non-forest, and covers all land management systems applied in the country. The reference period used for the construction of the FREL is the historical period 2000–2015, and, as described in the submission, Uganda anticipates that the FREL will be updated whenever improved data are available. The three land management systems comprise: private land; public land under the jurisdiction of the National Forest Authority (NFA), including central and local forest reserves; and public land under the jurisdiction of the Uganda Wildlife Authority (UWA), including national parks and wildlife reserves. The FREL is based on the annual average of historical CO₂ emissions associated with deforestation in the reference period, including only gross emissions from deforestation as a result of the conversion of forests and excluding any subsequent emissions and removals from the deforested areas. The FREL estimated by Uganda is not subject to adjustment for national circumstances under the provisions of decision 12/CP.17, paragraph 9.

12. For the construction of the FREL, activity data were derived from national land-use and land-cover maps. The information provided by all the maps is disaggregated into 13 land-use classes, 5 of which are considered forest and the rest non-forest classes. The maps were produced as part of the country’s national biomass study, covering different years, namely 1990, 2005, 2010 and 2015. The maps were produced using the best methodologies and satellite imagery available at the time, with emphasis on visual interpretation and ground truthing as part of the map generation. The land-use map for 2000 was produced using a different methodology. More specifically, the 1990 and 2005 maps were used to generate training data for a forest/non-forest mask. The mask was then combined with the Africover 2000 land use and land-use change data set in order to create the 13-class land use and land-use change classification. The maps for 2000 onwards were based on Landsat data, while SPOT 1 and 2 satellite imagery was used for the 1990 map.

13. Forests in Uganda comprise broadleaf and conifer plantations, tropical high forest that is well stocked (THF) or low stocked (THF1), and woodlands. For the development of emission factors, Uganda made use of various historical data sets, in particular information and data from its exploratory inventories, PSPs and the national biomass study, which were filtered to exclude data falling outside the FREL reference period for tree carbon stocks in Uganda’s forests. The national biomass study focused on land outside of the protected areas, providing information on woodlands on private land. Exploratory inventories have been

carried out since 2000 in forest production zones within protected areas managed by NFA and these inventories provide information on THF. PSPs have been established both in natural forests and in plantation forests, on public land managed by NFA. PSPs in natural forests are located mainly in THF. PSPs in plantation forests provide information for one point in time only (2006 or 2011), and therefore the NFA planting statistics data set covering the period 1990–2015 was used for plantations instead. More specifically, areas planted after 1999 were taken into consideration for the calculation of biomass stocks in plantations. The above-mentioned data sets were combined with the model proposed by Chave et al. (2014)¹¹ for estimating the above-ground biomass in THF and woodlands, while for plantations yield models from Alder et al. (2003)¹² were used.

14. Tree carbon stock was estimated by combining data from PSPs, exploratory inventories and the national biomass study, which provided carbon stocks or emission factors for THF or woodlands. The average carbon stocks for THF and THFI were calculated using an area-weighted mean, whereby the mapped area proportions of THF and THFI from the 2015 land-use and land-cover map were applied. PSP data on forest plantations (both coniferous and hardwood) were not considered representative because data were recorded on young plantations that had just been established. Therefore, mean annual increment was derived from the yield models (stem volume/ha) of Alder et al. (2003) using information on Caribbean pine for all pine species and *Eucalyptus grandis* for all other species. NFA tree planting statistics were used to estimate the proportions of pine and all other species. The site index was set to “poor site type” in order to use conservative yield estimates. The yield estimates were presented as a function of tree age, and tree volumes and mean annual yields were converted into above-ground biomasses using a biomass expansion factor of 1.3 for pine and 1.5 for other species (default value for tropical moist forest from the 2006 IPCC Guidelines).

15. As a result of the facilitative interactions with the AT during the TA, Uganda included a specific chapter in the modified submission listing in tabular format the identified areas for improvement, the current status of improvements and the anticipated actions to be taken in the short and long term. The AT commends Uganda for providing clarification during the TA and for increasing the transparency of its submission by including more detailed information in a specific chapter in the modified submission on areas for improvement.

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

16. Uganda used various data sets for developing the activity data and emission factors for the different forest types in the construction of its FREL. The AT noted that the information provided is dispersed among different sections of and/or annexes to the FREL submission, which reduces the overall transparency of the submission. As a result of the facilitative interactions with the AT, Uganda improved transparency in the modified submission by assembling the relevant information in the respective chapters and transferring essential information from the annexes to the main text (e.g. map accuracy assessment). The AT commends Uganda for this improvement.

17. Uganda used a combination of land-use and land-cover information for the classification of land (e.g. the national biomass study). In response to a question on how temporarily unstocked forest areas are distinguished from deforested areas, particularly in

¹¹ Chave J, Réjou-Méchain M, Búrquez A, et al. 2014. Improved allometric models to estimate the aboveground biomass of tropical trees. *Global Change Biology*. 20(10).

¹² Alder D, Drichi P and Elungat D. 2003. *Yields of Eucalyptus and Caribbean Pine in Uganda*. Consultancy report. Kampala: Uganda Forest Resources Management and Conservation Programme.

plantations, Uganda acknowledged the difficulties in doing so, especially in plantation areas outside the NFA and UWA management systems. For private plantations, Uganda explained during the TA that there is no plan for sustainable replanting; thus replanting cannot be ensured (although regeneration and/or replanting may occur). In addition, Uganda clarified that, during the map accuracy assessment (which took the year 2016 into account), plantations were classified as deforested if no sign of replanting was visible in the 2015 or 2016 imagery. The AT notes that this approach may fail to accurately reflect deforestation in plantations, and believes that an alternative approach would be for Uganda to develop criteria for distinguishing temporary loss of tree cover from deforestation; for example, a time period (in years), based on national circumstances, between loss of tree cover and successful regeneration or planting, after which the area is considered deforested. The AT commends Uganda for clarifying this issue during the TA, noting it as an area for future technical improvement.

18. For the development of activity data, Uganda used a minimum mapping unit of 2 ha. In response to a question from the AT, Uganda clarified that the minimum mapping unit applied to the original map data only and that it is theoretically possible that forest areas between 1 ha (forest definition) and 2 ha (minimum mapping unit) were omitted in the development of the original maps, which would result in an inaccurate land use and land-use change map for 2000–2015. Uganda explained that this was addressed through the map accuracy assessment process. The AT commends Uganda for improving the accuracy of the final estimates of activity data and considers harmonizing the minimum mapping unit to 1 ha as an area for future technical improvement because it would increase accuracy and help to build further confidence in the estimated emissions.

19. Uganda chose 2000 as the starting year for the reference period for the construction of its FREL, although the land-use and land-cover map for that year was created differently than the maps for 2005 and 2015 (see para. 12 above). The AT sought a number of clarifications in this respect, with the most important being (1) the content of the Africover 2000 land use and land-use change data set used for the development of the 2000 map, and (2) how consistency among the different data sets was ensured. Uganda clarified that the Africover 2000 data set is a hierarchical classification system based on a land-cover classification system that has been translated into 13 classes corresponding to the national biomass study classification system used for the years before and after 2000 for which maps were available (i.e. 1995 and 2005). The AT considers that the additional information provided by Uganda (in tabular format) on how the Africover data set corresponds to the 13 classes considerably increases the transparency of the FREL submission and clarifies how consistency among the different data sets was achieved.

20. Uganda included only gross emissions from deforestation in the FREL (see para. 7 above). During the TA, Uganda clarified that currently there are no available activity data from bias-corrected area estimates per final land use resulting from deforestation. However, Uganda has adequate data sources available for the reference period for developing activity data using remote-sensing and image interpretation techniques in combination with ground truthing (see para. 12 above). The AT considers that continued work on developing the necessary disaggregated activity data on final land uses as a result of deforestation and incorporating subsequent removals and/or emissions resulting from regeneration and/or planting in deforested areas would lead to improving the accuracy of the estimations, noting this as an area for future technical improvement.

21. Uganda used a stratification system of 13 classes (5 forest classes), with a separate forest class for THF and THFl, for the construction of the FREL. The AT sought a number of clarifications in this regard, the most important of which being (1) why for the final estimation of the FREL Uganda used only three out of five forest classes, namely THF, woodlands and plantations, merging the two types of THF into one, and (2) whether the same

emission factor was applied for both types of THF in the estimation of emissions from deforestation. Uganda explained that the 13 classes were used in developing the land-use and land-cover maps for the single years, while the bias-corrected area estimates developed during the accuracy assessment process do not differentiate between THF and THF1. Uganda acknowledged that the same emission factor (148 t carbon (C)/ha) was applied for both types of THF, owing to the lack of disaggregated bias-corrected activity data. In order to improve the accuracy of the estimation of emissions from deforestation in THF, and to avoid possible under- or overestimation of emissions, the AT proposed that Uganda apply a separate emission factor for each of the THF types based on the proportion of the two forest types of the total area, using available data sources (e.g. the 2002 national biomass study). As a result of the facilitative interactions during the TA, Uganda made recalculations, applying an area-weighted average emission factor for each of the THF types based on the 2015 land use and land cover map in the modified submission, which resulted in a 3 per cent decrease in the emission factor (i.e. down to 143 t C/ha). The AT notes that the value for above-ground biomass stock used by Uganda is within the default range (61–240 t C/ha) from the 2006 IPCC Guidelines. The AT commends Uganda for this improvement in the accuracy of the emission factor used and considers that continued work on disaggregating the land use and land-use change matrix by the main forest types would lead to improvements in the accuracy of the estimations, noting this as an area for future technical improvement. Moreover, the AT noted that, in table 10 of the submission, in which Uganda presents the carbon stocks for the three main forest classes, carbon stock of living biomass in plantations is reported as 72.4 t C/ha, while in table 11, which provides information used in the estimation of the emissions from deforestation, the emission factor for plantations (260.2 t CO₂ eq/ha) does not correspond to the above-mentioned carbon stock value. Uganda provided a modified submission where these values were corrected.

22. According to Uganda's modified submission, woodlands constitute the predominant forest type in the country as far as the area covered is concerned (approximately 64 per cent of the total forest area in 2015 was woodlands). Furthermore, the majority (82.5 per cent) of deforestation activities take place in woodland areas. In 2000–2015 the area of woodlands in Uganda decreased by approximately 28 per cent, with the highest forest loss being identified in private land areas (approximately 36 per cent). The main source for emission factors for woodlands is the national biomass study, in which only 13 per cent of the sampling plots refer to woodlands. Given the high share of woodlands in deforested areas, and considering that this forest type is very prone to forest fires (according to Uganda's second national communication, woodlands accounted for the highest level of non-CO₂ emissions from forest fires in 2000), the AT sought a number of clarifications in this regard, the most important of which was whether Uganda further stratifies woodlands in terms of activity data and emission factors in order to avoid over- or underestimating emissions. During the TA, Uganda explained that currently it is not possible to further stratify woodlands for activity data or emission factors; therefore, Uganda applied the same emission factor for the whole woodland area (20 t C/ha for above-ground biomass), acknowledging that the emission factor is biased towards land outside of protected areas, as the national biomass study on woodlands was primarily meant to generate data on biomass stocks for fuelwood under the assumption that biomass in protected areas was not accessible. Uganda informed the AT that measurements in woodlands are ongoing and updated data on emission factors are expected. The AT commends Uganda for continuing to work on updating and improving the accuracy of both activity data and emission factors for woodlands, noting this as an area for future technical improvement.

23. For converting biomass to carbon, Uganda used the carbon fraction value proposed in the IPCC good practice guidance for LULUCF (0.5 t C/t dry matter). In addition, the AT noted that a value of 0.24 was used as the ratio of below-ground biomass to above-ground biomass for estimating emissions from deforestation, and that it is likely inaccurate to use the

same value for all forest types. The AT considers it an area for future technical improvement to apply a different root–shoot ratio for each forest type and/or forest substratum in order to improve the accuracy of the estimations. The AT also notes that the 2006 IPCC Guidelines provide updated factors for both carbon fraction and root–shoot ratio.

24. There are significant differences between the national activity data and the data derived from the Global Forest Change database (Hansen et al., 2013)¹³: Global Forest Change data show an area of 8 million ha forest for 2000 with tree cover above 30 per cent, which is considerably higher than the national forest area estimate for 2000 of 3.1 million ha. Uganda provided detailed explanations of such differences, noting the different definitions used for the mapping. For instance, the Global Forest Change data maps a lot of the wetlands and subsistence farmlands as high tree cover, while it omits some of the woodlands in northern Uganda that are captured by the national data. However, the AT noted that the rate of deforestation reported in the FREL (50,147 ha/year in the period 2000–2015) is not of the same order as the rate of deforestation derived from the Food and Agriculture Organization of the United Nations *Global Forest Resources Assessment 2015* (FRA) for the period 2000–2015, which is approximately 120,000 ha/year. In response to a question from the AT, Uganda explained that for its FREL and the FRA different approaches were used for estimating area change (i.e. comparing time-series map areas versus using bias-corrected area estimates of forest change). In addition, Uganda pointed out that the FRA 2015 was published when only 81 per cent of the country area had been mapped or classified, and that no verification or validation had been done. The AT acknowledges that exact agreement would not be expected between the different data sources, and considers that further explanation of the differences between the FREL submission and reported information to other international organizations would improve the transparency of the FREL submission, noting this as an area for future technical improvement.

25. In order to reduce the uncertainty of activity data, Uganda implemented bias-correction procedures. As a first step, a manual review and revision and an automated consistency check of the original maps was performed, followed by an accuracy assessment using reference sampling data in order to provide final bias-corrected estimates. For the accuracy assessment, Uganda followed guidance provided by Olofsson et al. (2014)¹⁴ and the Food and Agriculture Organization of the United Nations (2016).¹⁵ The AT commends Uganda for performing accuracy assessment activities and incorporating the results into the final activity data estimation process, and considers that continuing efforts to update and improve the accuracy of activity data would further reduce uncertainties.

Description of relevant policies and plans, as appropriate

26. No assumptions about future changes to domestic policies were included in the construction of the FREL submitted by Uganda in accordance with decision 13/CP.19, annex, paragraph 2(h).

27. Information on relevant domestic policies and plans was provided in different sections of the FREL submission. Uganda provided detailed information on the national institutional arrangements under the REDD-plus process. The national REDD-plus strategy includes measures and actions for addressing the drivers of deforestation and forest degradation, and

¹³ Hansen, M C, Potapov, P V, Moore, R et al. 2013: High-Resolution Global Maps of 21st-Century Forest Cover Change. *Science*, 342(6160): pp.850-853.

¹⁴ Olofsson P, Foody GM, Herold M, et al. 2014. Good practices for estimating area and assessing accuracy of land change. *Remote Sensing of Environment*. 148: pp.42–57.

¹⁵ Food and Agriculture Organization of the United Nations. 2016. *Map Accuracy Assessment and Area Estimation: A Practical Guide*. National forest monitoring assessment working paper No.46/E. Rome: Food and Agriculture Organization of the United Nations. Available at <http://www.fao.org/3/a-i5601e.pdf>.

also actions related to the other three REDD-plus activities. The driving parameters for categorizing REDD-plus activities are the forest types and transitions and the management systems found in the country. As its overarching national development goal, Uganda set the ambitious plan of restoring its forest area to the 1990 level. Uganda presented, in tabular format in a specific section of its FREL submission, a summary of strategic options and actions related to all REDD-plus activities.

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

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

29. The pools included in the FREL are above-ground biomass and below-ground biomass. The deadwood, litter and soil carbon pools were not included.

30. Uganda indicated in its modified submission that data on lying deadwood were collected from the PSPs; however, they were considered to be not adequately representative to be used for the emission estimations. Uganda acknowledged that the deadwood pool may be significant for both THF and woodlands, and this has been identified as an area for future technical improvement of the FREL. Uganda informed the AT that, as part of the new exploratory inventory measurements for REDD-plus (started in 2016), data on lying deadwood have been collected, while data on lying and standing deadwood are being gathered in the context of the ongoing national forest inventory. The AT considers the inclusion of emissions from deadwood as an area for future technical improvement of the FREL.

31. The litter pool was excluded from the FREL on the basis of it being considered insignificant. Uganda justified the exclusion using default data from the 2006 IPCC Guidelines, owing to the lack of national data on litter, showing that litter carbon stocks amount to approximately 1.4–3.5 per cent of total above- and below-ground biomass carbon stocks in THF. There are currently no plans to collect data on the litter pool. The AT agrees that the litter pool is likely to be insignificant as far as its contribution to the total emissions from deforestation is concerned.

32. Uganda excluded the soil carbon pool from its FREL. The AT noted that, for its second national communication, Uganda applied tier 1 methodologies from the IPCC good practice guidance for LULUCF to estimate CO₂ emissions from soils. Uganda confirmed that, by applying tier 1 methodologies, emissions from the soil organic matter pool from deforestation were estimated to be approximately 30 per cent of the total land use, land-use change and forestry emissions, and that the final decision to exclude the soil carbon pool from the estimation of the FREL was due to the lack of reliable country-specific data. In order to demonstrate that the emissions from the pool are not significant, Uganda used default data from the 2006 IPCC Guidelines: the resulting estimations showed that soils account for 0.6–2.6 per cent of the above- and below-ground biomass carbon stocks. Uganda informed the AT that the National Agricultural Research Organisation and the National Agricultural Research Laboratories are already updating the soils database for the country in order to provide the necessary data for estimating carbon stock changes in soils using country-specific data. The AT agrees that the emissions from the soil carbon pool are likely to be insignificant in terms of their contribution to emissions from deforestation, however, the AT notes that the impact of a land-use change (deforestation) on carbon stocks occurs over 20 years (default IPCC factor). Furthermore, the AT notes that the IPCC good practice guidance for LULUCF provides a method for estimating carbon stock changes in soils and corresponding default emission factors for applying tier 1 methodologies. The AT considers the inclusion of emissions from soils as an area for future technical improvement of the FREL with the aim

of maintaining consistency with the GHG inventory included in the national communication, noting also decision 12/CP.17, annex, subparagraph (c).

33. The only gas included in the FREL is CO₂ resulting from carbon stock changes in above- and below-ground biomass owing to deforestation. The AT notes that, according to the latest national GHG inventory, submitted with the second national communication, Uganda recognizes that fires may be a major source of degradation of land, and also applied methodologies to estimate associated non-CO₂ emissions. Data on areas affected by forest fires were reported in the FRA 2015 for the period 2003–2012. Uganda acknowledged in its FREL submission that wildfires constitute one of the key drivers of deforestation and forest degradation in the country. In response to a question raised by the AT, Uganda explained that using the same data source as for the second national communication (namely the Moderate Resolution Imaging Spectroradiometer of the National Aeronautics and Space Administration) the forest area burned in 2015 was estimated at 41 kha, which is only one tenth of the forest burned in 2000 (550 kha). Given that its forests have declined significantly over time, Uganda expects emissions related to forest fires to be insignificant. Uganda clarified to the AT that emissions associated with forest fires were not taken into account in the FREL owing to the low accuracy of the activity data on the areas affected. As a result of the facilitative technical exchange of information during the TA, Uganda included annex 10 to the modified submission, which provides detailed information on the estimation of non-CO₂ emissions from forest fires for 2015. The AT commends Uganda for providing detailed information in the modified submission. The AT understands that forest fires in recent years might not have been a significant source of emissions, but notes that there are years in the reference period (e.g. 2000) and potentially also in the future when fires would result in significant CO₂ and non-CO₂ emissions. The AT considers that the inclusion of emissions from forest fires would enhance consistency between the FREL submission and the GHG inventory, ensuring also that over- or underestimation of emissions is avoided, noting this as an area for future technical improvement.

34. The AT acknowledges that Uganda included the most significant activity (reducing emissions from deforestation) of the five activities identified in decision 1/CP.16, paragraph 70, in accordance with its national capabilities and circumstances. According to Uganda, the reason for not including the other four activities is the lack of robust and adequate activity data and emission factors to allow the accurate assessment of the GHG balance for the land areas where the activities take place. The AT notes that other activities could also be significant, in particular enhancement of forest carbon stocks, forest degradation and, more specifically, degradation on private land. The AT also notes that future actions to control and/or limit deforestation activities in the country may be associated with an increase of emissions for other land areas as a result of forest degradation. The AT acknowledges the intention expressed by Uganda to include more activities in future FRELs when new, adequate data and better information become available, as part of the stepwise approach.

4. Definition of forest

35. Uganda provided in its submission the definition of forest used in the construction of the FREL. Forest is defined as land covered by trees with a minimum crown cover of 30 per cent, a minimum tree height (in situ) of 4 m or the potential to reach it, and a minimum area of 1 ha. According to Uganda's forest definition, tree refers to any perennial plant, while bamboo is considered a special tree of national interest under REDD-plus. Seasonal woody forms (e.g. *Solanum giganteum*, *Acanthus pubescens*), orchards (e.g. oil palms), which are considered agricultural crops, and agroforestry and silvopastoral systems are excluded. Uganda also indicated in its submission that it may redefine its forest definition once the capacity to monitor forest changes has improved.

36. The AT sought a number of clarifications on Uganda's forest definition, the most important being the following:

(a) The AT noted that the forest definition provided in the FREL submission is different from the one used for the latest GHG inventory as part of the second national communication, according to which the minimum tree height is 5 m. Uganda explained that the land-use and land-cover maps developed for the national biomass study and the subsequent ones developed for 2000, 2005, 2010 and 2015 by NFA, which were used for the construction of the FREL, used 4 m minimum threshold for tree height. Uganda informed the AT that, as a result of internal consultations on this matter between the task forces, the National Technical Committee and the National Climate Change Advisory Committee, it was agreed that the 4 m tree height threshold adequately represents the national forest conditions, especially woodlands. Uganda explained that the 5 m threshold was used in the definition adopted for the clean development mechanism under the Kyoto Protocol, and that for both the first and second national communications that definition was referred to but the data was based on 4 m. Nevertheless the data used were from NFA, so no inconsistencies occurred between the latest national GHG inventory and the FREL submission as far as the GHG emission estimations are concerned. Uganda acknowledged the problems arising from the use of different forest definitions for different reporting purposes, and informed the AT that the forest definition adopted for the FREL for REDD-plus purposes will also be used for the third national communication;

(b) The AT noted that, although bamboo is of national interest for Uganda, no further information was provided in the FREL submission on the implication of bamboo areas for the estimation of the FREL. Uganda explained to the AT that the importance of bamboo lies in the fact that it provides unique services to communities (food, furniture, construction material, shelter, and special tools and decoration), and that the intention is to promote its sustainability, including the possibility of promoting its growth. Consequently, Uganda acknowledged that, in spite of the importance of bamboo, mapping it is still a challenge, and it was included in the FREL with the aim of making it as comprehensive as possible;

(c) The AT asked for more information on the intention of Uganda to revise the forest definition in the future once national capabilities permit. Uganda explained and clarified in the modified submission that any consideration of changing the forest definition refers only to the minimum area, and that it will only take place once capacity and technology improvements in the country allow the monitoring of forest areas smaller than 1 ha.

37. The AT commends Uganda for providing detailed explanations of the forest definition and for the efforts made to increase consistency following the provisions of decision 13/CP.19, annex, paragraph 2(g). The AT recognizes that the FRA data might have been developed with a different forest definition (see para. 24 above); however, Uganda could provide information in its submission on differences in its reporting to international organizations in an effort to increase transparency. The AT considers that any future change of the national forest definition is very likely to affect the overall internal consistency of the whole time series of GHG emission estimates related to the national GHG inventory and the FREL.

III. Conclusions

38. The information used by Uganda in constructing its FREL for the activity "reducing emissions from deforestation" is transparent, complete and in overall accordance with the guidelines for submissions of information on FRELs/FRLs (as contained in the annex to decision 12/CP.17). The methodologies applied for estimating GHG emissions are consistent with the IPCC good practice guidance for LULUCF and the 2006 IPCC Guidelines. The AT

considers that the FREL submission with its annexes, together with the additional information and clarifications provided by Uganda during the TA, facilitated the understanding of the construction of the FREL and the identification of areas for future technical improvement.

39. The AT acknowledges that Uganda included in its national FREL the most significant activity, the most important forest types and the most significant pools in terms of emissions from forests. The AT commends Uganda for the information provided on the ongoing work to develop FRELS for other activities, applying a stepwise approach in accordance with decision 12/CP.17, paragraph 10. As a result of the facilitative interactions with the AT during the TA, Uganda submitted a modified submission that took into consideration the technical input of the AT. The AT notes that the transparency and completeness of information was improved significantly in the modified FREL submission and commends Uganda for the efforts made. The new information provided in the modified submission, including in new annexes, on how estimates of CO₂ emissions from deforestation were calculated increased the reproducibility of the FREL calculations.

40. The AT notes that, overall, the FREL maintains consistency, in terms of sources of activity data and emission factors, with the GHG inventory included in Uganda's latest national communication.¹⁶ However, inconsistencies were found with regard to emissions from the soil and deadwood carbon pools, and non-CO₂ emissions, which were excluded from the FREL but included in the national communication.

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

- (a) Developing criteria for distinguishing temporary loss of tree cover from deforestation (see para. 17 above);
- (b) Harmonizing the minimum mapping unit at 1 ha with a view to increasing accuracy and helping to build confidence in the estimated emissions (see para. 18 above);
- (c) Providing additional information on how the Africover data set corresponds to the 13 land-use classes of the national biomass study (see para. 19 above);
- (d) Continuing work on developing the necessary disaggregated activity data for final land uses resulting from deforestation and incorporating any subsequent removals and/or emissions resulting from regeneration and/or planting in deforested areas (see para. 20 above);
- (e) Disaggregating the land use and land-use change matrix by the main forest types (see para. 21 above);
- (f) Updating and improving the accuracy of both activity data and emission factors for woodlands (see para. 22 above);
- (g) Applying different root–shoot ratios for each forest type and/or forest substratum in order to improve the accuracy of the estimations (see para. 23 above);
- (h) Further explaining the differences between information in the FREL submission and information reported to other international organizations (see para. 24 above);
- (i) Continuing efforts to update and improve the accuracy of activity data to further reduce uncertainties (see para. 25 above);
- (j) Including emissions from deadwood (see para. 30 above);

¹⁶ In reference to the scope of the TA, decision 13/CP.19, annex, paragraph 2(a).

(k) Including emissions from soils with the aim of maintaining consistency with the GHG inventory included in the national communication (see para. 32 above);

(l) Including emissions from forest fires, which would enhance consistency between the FREL submission and the GHG inventory, ensuring also that over- and underestimation of emissions is avoided (see para. 33 above);

(m) Including additional REDD-plus activities in future FRELs when new, adequate data and better information become available, as part of the stepwise approach (see para. 34 above);

(n) Harmonizing the different forest definitions used for constructing the FREL and for the latest national GHG inventory (see para. 36 above).

42. The AT acknowledges and welcomes the intention expressed by Uganda in the modified submission to consider for future FREL/FRL submissions:

(a) Including additional REDD-plus activities;

(b) Including additional carbon pools;

(c) Including non-CO₂ gases;

(d) Using higher-resolution satellite imagery to map small woodlots and improve the quality of activity data;

(e) Updating emission factors using additional forest inventory data currently being collected.

43. In conclusion, the AT commends Uganda for showing a strong commitment to the continuous improvement of its FREL estimates in line with the stepwise approach. A number of areas for future technical improvement of Uganda's FREL 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.¹⁷ The AT also acknowledges that the assessment process was an opportunity for a rich, open, facilitative and constructive technical exchange of information with Uganda.

44. The table contained in the annex summarizes the main characteristics of Uganda's proposed FREL.

¹⁷ 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 based on information provided by the Party

<i>Main features of the FREL</i>		<i>Remarks</i>
Proposed FREL (in t CO ₂ eq/year)	8 254 691	Uganda submitted its proposed FREL in January 2017. As a result of the facilitative technical exchange of information and clarification during the technical assessment, Uganda submitted a modified version of its proposed FREL on 4 February 2018 (see para. 7 of this document)
Type and duration of FREL	FREL = average historical emissions from 2000 to 2015	The FREL is the annual average of historical CO ₂ emissions associated with deforestation (see para. 7 of this document)
Adjustment for national circumstances	No	
National/subnational ^a	National	See paragraph 7 of this document
Activities included ^b	Deforestation	The FREL includes only gross emissions from deforestation resulting from the conversion of forests and excludes any subsequent emissions and removals from the deforested areas (see para. 11 of this document)
Pools included ^b	AB, BB	There is a lack of accurate data on the omitted pools. Plans are in place to provide data on deadwood and soils in the future (see paras. 30–32 of this document)
Gases included	CO ₂	Although non-CO ₂ emissions were estimated for the latest national GHG inventory, they were not included in the FREL, with the justification that they are insignificant and the accuracy of the data is uncertain (see para. 33 of this document)
Forest definition ^c	Included	Land covered by trees with a minimum crown cover of 30%, a minimum tree height (in situ) of 4 m or the potential to reach it, and a minimum area of 1 ha. Seasonal woody forms, orchards, agroforestry and silvopastoral systems are excluded (see para. 35 of this document)
Relationship with latest GHG inventory	Methods used for the FREL are consistent with the latest GHG inventory (2014)	Emissions from soils as a result of deforestation, and non-CO ₂ emissions from forest fires were estimated for the latest national GHG inventory, but were not taken into account in the construction of the FREL (see paras. 32–33 of this document)
Description of relevant policies and plans ^d	Included	See paragraph 27 of this document

<i>Main features of the FREL</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	Several areas for future technical improvement were identified (see paras. 41 and 42 of this document)

Abbreviations: AB = above-ground biomass, BB = below-ground biomass, FREL = forest reference emission 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.