



Technical report on the technical analysis of the technical annex to the first biennial update report of Malaysia submitted in accordance with decision 14/CP.19, paragraph 7, on 3 March 2016

Summary

This technical report covers the technical analysis of the technical annex that was submitted on a voluntary basis by Malaysia through its first biennial update report, in accordance with decision 14/CP.19. The technical annex covers data and information on the activity “sustainable management of forests”, which is one of the activities included in decision 1/CP.16, paragraph 70. The activity covers only the production forests within the permanent reserved forests of the country as used to construct the assessed forest reference level proposed by Malaysia in its modified submission of September 2015. Malaysia reported results from this activity for the period 2006–2010 amounting to removals of 97.47 million tonnes of carbon dioxide equivalent.

The technical analysis concluded that the data and information provided by Malaysia in the technical annex are consistent with the assessed forest reference level that was established in accordance with decision 1/CP.16, paragraph 71(b), and decision 12/CP.17, chapter II. In addition, the data and information provided are in overall accordance with the guidelines contained in the annex to decision 14/CP.19. The technical analysis noted several areas where Malaysia could improve on its data and information in order to enhance the transparency and accuracy of its estimates.

This report contains the findings of the technical analysis and a few areas identified for further technical improvement, according to decision 14/CP.19, paragraph 14.

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I. Introduction, overview and summary

A. Introduction

1. This technical report covers the technical analysis (TA) of the technical annex¹ provided in accordance with decision 14/CP.19,² included in the first biennial update report (BUR) of Malaysia that was submitted on 3 March 2016.³ In the technical annex, Malaysia provided data and information used in the estimation of anthropogenic forest-related emissions by sources and removals by sinks resulting from the implementation of one of the activities referred to in decision 1/CP.16, paragraph 70 (hereinafter referred to as REDD-plus activities).⁴ The submission of the technical annex is voluntary and in the context of results-based payments.⁵

2. The TA of the technical annex is part of the international consultation and analysis (ICA) of BURs referred to in decision 2/CP.17, annex IV, paragraph 4. The objective of the ICA is to increase the transparency of mitigation actions and their effects through analysis by a team of technical experts (TTE) in consultation with Malaysia and through a facilitative sharing of views, and will result in a separate summary report.⁶

3. Malaysia submitted a proposed forest reference level (FRL), in accordance with the provisions of decision 13/CP.19, on 8 December 2014, which was subjected to a technical assessment. Taking into consideration the technical inputs of the technical assessment team, Malaysia submitted a modified submission of its proposed FRL on 24 September 2015.⁷ The findings of the technical assessment based on the modified submission are included in a separate report.⁸ A summary of the assessed FRL was included in the technical annex referred to in paragraph 1 above.

B. Process overview

4. The TA of Malaysia's first BUR took place (as a centralized activity) from 13 to 17 June 2016 in Bonn, Germany, and was undertaken by the following TTE drawn from the UNFCCC roster of experts on the basis of the criteria defined in decision 20/CP.19, annex, paragraphs 2–6: Ms. Maria Fernanda Alcobé (Argentina), Ms. Inge Jonckheere (Belgium), Mr. Carlos Fuller (former member of the Consultative Group of Experts on National Communications from Parties not included in Annex I to the Convention (CGE) from Belize), Ms. Estefania Ardila Robles (member of the CGE from Colombia), Mr. Felipe de León (Costa Rica), Mr. Jorge Eduardo Morfín Ríos (Mexico), Ms. Marieke Sandker (Netherlands) and Ms. Rosa Maria Rivas Palma (member of the CGE from New Zealand).

¹ The technical annex to the BUR is titled "Technical Annex 2: Seeking to obtain and receive payments for REDD+ results-based actions (decision 14/CP.19)".

² Decision 14/CP.19, paragraph 7.

³ Decision 2/CP.17, paragraph 41(a), and annex III, paragraph 19.

⁴ In decision 1/CP.16, paragraph 70, the Conference of the Parties encouraged 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.

⁵ Decision 14/CP.19, paragraph 8.

⁶ FCCC/SBI/ICA/2016/TASR.1/MYS, published on 21 February 2017.

⁷ The original and modified submissions are available at <<http://redd.unfccc.int/submissions.html?country=mys>>.

⁸ FCCC/TAR/2015/MYS, published on 17 December 2015.

Ms. Ardila Robles and Ms. Rivas Palma were the co-leads for the TA. Mr. Morfín Ríos and Ms. Sandker were the land use, land-use change and forestry (LULUCF) experts that undertook the TA of the technical annex and prepared this technical report in accordance with decision 14/CP.19, paragraphs 10–14.

5. During the TA, the LULUCF experts and Malaysia engaged in several technical exchanges, during which Malaysia provided clarifications to questions raised by the experts. These discussions facilitated a common understanding and provided further clarifications on the technical annex and the identification of areas for technical improvement. Following the TA of the technical annex, the LULUCF experts prepared and shared the draft technical report with Malaysia for its review and comment.

6. The LULUCF experts responded to and incorporated the comments referred to in paragraph 5 above and finalized this technical report in consultation with Malaysia.

C. Summary of results

7. In decision 1/CP.16, paragraph 70, the Conference of the Parties encouraged developing country Parties to contribute to mitigation actions in the forest sector by undertaking a number of activities, as deemed appropriate by each Party and in accordance with their respective capabilities and national circumstances. In the context of results-based payments and in line with decision 12/CP.17, Malaysia, on a voluntary basis, submitted an FRL covering the activity “sustainable management of forests” for the purpose of a technical assessment in accordance with decision 13/CP.19 and its annex. The activity was implemented in Malaysia’s production forests included within the permanent reserved forests (PRF) of the country. The production forest area changes annually, consisting of 12.92 million hectares (M ha) in 2006 and 12.59 M ha in 2010. In 2006 and 2010, the production forest area comprised 89 and 87 per cent of the PRF, respectively, or 73 and 70 per cent of the total forest area of Malaysia, and amounted to 39 and 38 per cent of the national territory, respectively. The FRL includes the above-ground biomass and below-ground biomass carbon pools and was developed using average historical carbon dioxide (CO₂) emissions and removals from the activity sustainable management of forests between 1992 and 2005. The FRL gave a net annual removal of 183.55 million tonnes of CO₂ equivalent per year (Mt CO₂ eq/year). Malaysia is seeking to obtain and receive payments for the results of the activity sustainable management of forests for the period 2006–2010, measured against the assessed FRL. The total result achieved for the period 2006–2010 was an increase in average net removals of 97.47 Mt CO₂ eq for the five-year period, calculated as the sum of the annual difference between the net removals for the years 2006–2010 and the FRL of –183.55 Mt CO₂ eq/year. Approximately 77 Mt CO₂ eq of the removals are the result of a reduction in emissions from reduced harvesting and approximately 20 Mt CO₂ eq are the result of an increase in removals associated with an increased area in production forests during the five-year period.

II. Technical analysis of information reported in the technical annex to the biennial update report

A. Technical annex

8. For the technical annex to the first BUR submitted by Malaysia, see the annex to this report.⁹

B. Technical analysis

9. The scope of the TA is outlined in decision 14/CP.19, paragraph 11, according to which the TTE shall analyse the extent to which:

(a) There is consistency in methodologies, definitions, comprehensiveness and the information provided between the assessed FRL and the results of the implementation of the REDD-plus activities;

(b) The data and information provided in the technical annex are transparent, consistent, complete and accurate;

(c) The data and information provided in the technical annex are consistent with the guidelines referred to in paragraph 9 of decision 14/CP.19;

(d) The results are accurate, to the extent possible.

10. The remainder of this chapter presents the results of the TA of the technical annex to the BUR according to the scope outlined in paragraph 9 above.

1. Consistency in methodologies, definitions, comprehensiveness and the information provided between the assessed reference level and the results in the technical annex

11. In accordance with paragraph 3 of decision 14/CP.19, the data and information used by Parties in the estimation of anthropogenic forest-related emissions by sources and removals by sinks, forest carbon stocks, and forest carbon stock and forest-area changes related to REDD-plus activities undertaken by Parties should be transparent, and consistent over time and with the established forest reference emission levels (FRELs) and/or FRLs in accordance with decision 1/CP.16, paragraph 71(b) and (c), and decision 12/CP.17, chapter II.

12. The results from the implemented activity sustainable management of forests are obtained by introducing a cap on cutting limits in which a maximum harvesting limit of 85 m³/ha is set and by increasing the area of PRF that also includes the production forests.

13. The LULUCF experts note that Malaysia has been consistent in using the same methods and definitions for developing the FRL and for estimating the results from the implementation of the activity sustainable management of forests during the period 2006–2010. The LULUCF experts also note that Malaysia has been consistent in the data and information provided, including the same pools, gases and activity, in both the FRL and the REDD-plus results. The overall consistency relates to:

(a) The generation of activity data, which the LULUCF experts consider as consistent as far as can be assessed. In response to a question from the LULUCF experts, Malaysia clarified that the generation of activity data for the calculation of emissions

⁹ Decision 14/CP.19, paragraph 14(a).

resulting from the activity sustainable management of forests consists of annual figures on commercial harvest obtained from Malaysia's National Commodity Statistic Reports.¹⁰ The annual production figures are verified against the levy and royalties collected. The generation of activity data for the calculation of removals resulting from the activity sustainable management of forests is derived from the areas designated as production forests inside the PRF, and classified as inland forest, peat swamp forest and mangrove forest. The area of production forest was obtained from statistics on gazetted areas from the State Economic Planning Unit, which were verified and corrected using geospatial images for the years 1990, 2000 and 2010. The intermediate years were calibrated accordingly. Changes in the area of production forest are obtained annually following approval by the State Executive Council on gazetted and degazetted areas. From 2010 onwards, biannual geospatial image interpretation is used to verify changes in the PRF and to assess forest health, encroachment and illegal logging. Geospatial monitoring is also used to classify different forest types within the PRF. Landsat data were used for the period 1992–2005, while a combination of data from SPOT-2, SPOT-4 and Landsat was used for 2006–2009. The LULUCF experts commend Malaysia for improving its change assessment of forest types within the production forests in the PRF and note that there are no apparent inconsistencies with the introduction of SPOT data;

(b) Using the same methodologies and data to generate emission and removal factors, in particular, the application of the same emissions per cubic metre extracted and the same growth rate per forest type for both the FRL and the REDD-plus results calculations;

(c) Including the same two carbon pools, above-ground and below-ground biomass, for the calculation of removals and emissions associated with the activity sustainable management of forests for both the FRL and REDD-plus results. The assumption that all carbon from the two pools is lost in the year of extraction is applied and a uniform overall growth rate is applied to estimate above-ground and below-ground biomass in the production forest area (differentiated according to forest type) regardless of age or silvicultural treatment;

(d) Including the same gases: CO₂ only;

(e) Including the same activity and area: sustainable management of forests within the production forests in the PRF;

(f) Using a forest definition that is consistent with the forest definition used for the construction of the FRL.

14. The LULUCF experts conclude that the presentation of the results from the implementation of the activity sustainable management of forests is consistent with the assessed FRL, noting that the geographical area covered in both the FRL and the REDD-plus results changes annually and is on average larger for the reporting period of REDD-plus results (see para. 15 below). The LULUCF experts commend Malaysia for ensuring consistency in the methodologies and definitions applied, and in the comprehensiveness of information provided between the assessed FRL and the REDD-plus results.

2. Transparency, consistency, completeness and accuracy of the data and information provided in the technical annex

15. The LULUCF experts note that the area subject to the activity sustainable management of forests (production forest inside the PRF) changes annually and is, on

¹⁰ Ministry of Primary Industries and Commodities National Commodity Statistic Reports for the years 1994, 2000, 2005, 2010 and 2012.

average, smaller under the FRL period than under the REDD-plus results reporting period. The LULUCF experts therefore note that the increase in removals which forms part of the results reported (approximately 20 per cent) is due to an increase in production forest area. The experts, as part of the technical exchange, asked Malaysia how this area was defined before inclusion in production forest in the PRF (during the FRL period). In response, Malaysia clarified that this area was forest but would have been deforested had it not been gazetted as production forest area. Based on this clarification, the LULUCF experts noted that if this area was already forest, then the current calculation implicitly assumes the annual change in carbon stocks in biomass (ΔC_B) (equation 2.7 in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (hereinafter referred to as the 2006 IPCC Guidelines)) to be zero for the stateland forest prior to gazettement. However, this assumption is not supported by data indicating that the annual increase in carbon stocks due to biomass growth (ΔC_G) in equation 2.7 is higher, or that the annual decrease in carbon stocks due to biomass loss (ΔC_L) is lower inside the production forests within the PRF. Malaysia clarified that the increase in forest areas is directly due to the implementation of the Central Forest Spine and Heart of Borneo projects, where the primary objective was to reduce forest fragmentation and enhance the connectivity of these forest ecosystems. Stateland forest was gazetted as PRF to ensure that the connectivity between the forests is maintained. Malaysia explained that it would include these results in a future FREL/FRL submission when adding the activity “reducing emissions from deforestation” and/or the activity “enhancement of forest carbon stocks”.

16. During the TA, Malaysia provided additional information, including the sources of data and information used in generating growth rates. The LULUCF experts were informed by Malaysia that the national forest inventory (NFI) data are available in the national language and in print form only at the Forestry Department of Peninsular Malaysia in Kuala Lumpur and are not accessible online. The LULUCF experts acknowledge these efforts by Malaysia to increase the transparency and contribute to the completeness¹¹ of the data and information provided for the reporting of REDD-plus results.

17. Referring to decision 12/CP.17, paragraph 8, the FRL shall be established by taking into account decision 4/CP.15, paragraph 7, and maintaining consistency with anthropogenic forest-related greenhouse gas (GHG) emissions by sources and removals by sinks as contained in each country’s GHG inventory. The assessment team for the FRL noted that methods used for the FRL differed from those used for the latest GHG inventory in Malaysia’s second national communication, submitted in 2011. The LULUCF experts looked at the GHG inventory included in the BUR, which applied an updated methodology. They noted that, overall and in terms of data sources used for the activity data and emission and removal factors, both the FRL and the estimation of REDD-plus results maintain consistency with the GHG inventory included in the BUR. The LULUCF experts also noted that the emission and removal (growth rate) factors for forest reported in the first BUR (annex 1, table B, page 117) used a carbon fraction of 0.50, while those used for the construction of the FRL and the REDD-plus results used a carbon fraction of 0.47. Malaysia indicated that it plans to use the carbon fraction of 0.47 for its GHG inventory to be submitted with its third national communication and second BUR in accordance with the 2006 IPCC Guidelines. The LULUCF experts commend Malaysia for planning to enhance the consistency of reported values.

18. In response to a question from the LULUCF experts on how the commercial harvest is distributed over the three different forest types (inland forest, peat swamp forest and mangrove forest), Malaysia clarified that this information is not readily available as a national statistic but the majority of harvest takes place in the inland forests. This is the

¹¹ Completeness here means the provision of information that allows for reconstruction of the results.

reason why Malaysia applied the values for inland forest (root-to-shoot ratio) in the calculation of emissions from commercial harvest inside the production forest.

19. In response to a question from the LULUCF experts, Malaysia clarified that the data used to estimate the growth rates for forests inside the PRF were obtained by re-measuring trees in permanent sample plots in NFI cycles 4 (2002) and 5 (2012) as well as re-measuring trees in permanent sample plots not part of the NFI. These data are contained in national studies¹² for all forest types (inland, peat swamp and mangrove forests). The growth rate values cited in the study by Banin et al. (2014)¹³ were not used in establishing the growth rate values but were included for comparison only. Malaysia further clarified that growth rates for mangroves were taken from a study by Ong (1993),¹⁴ and were converted to net growth rates by deducting a mortality rate obtained from national studies¹⁵ (see also para. 20 below).

20. In response to a question from the LULUCF experts, Malaysia clarified that mortality rates were included in its estimation of net growth rates, contrary to that noted in the technical assessment of its proposed FRL (see document FCCC/TAR/2015/MYS, para. 16: “Malaysia indicated that recalculations of its net growth rates to be made following the availability of data from the fifth NFI will include mortality losses”). For inland, peat swamp and mangrove forests the mortality rates are obtained by observations on the number of standing and fallen dead trees in the sample plots as well as from national studies. For inland, peat swamp and mangrove forests a mortality rate of 0.273, 0.429 and 0.96 tonnes of dry matter (t DM) per ha per year, respectively, was applied. Stem diameter measurements from the NFI were converted to above-ground biomass per tree using the equation by Brown (1997)¹⁶ for inland and peat swamp forests. The growth rates for these forest types are as follows: (i) inland forest is based on re-measurements in 218 permanent sample plots in Malaysia; and (ii) peat swamp forest is based on re-measurements in 3 permanent sample plots in Peninsular Malaysia (2002–2012) and re-measurements in an additional 13 sample plots in Sarawak and Sabah (1992–2008). Biomass increment is determined for each diameter class and converted to biomass increment per hectare estimates by multiplying the average increase per diameter class by the number of trees in the plot of this diameter class. For mangroves, mean annual increment of 25-year old stands was taken from Ong (1993), from which the mortality rate from national studies was deducted to convert into a net growth rate.

¹² These are ongoing studies that were allocated under the ninth and tenth Malaysian Development Plans (for the periods 2006–2010 and 2011–2015, respectively).

¹³ Banin L, Lewis SL, Lopez-Gonzalez G, Baker TR, Quesada CA, Chao K-J, Burslem DFRP, Nilus R, Abu Salim K, Keeling HC, Tan S, Davies SJ, Monteagudo Mendoza A, Vasquez R, Lloyd J, Neill DA, Pitman N and Phillips OL. 2014. Tropical forest wood production: a cross-continental comparison. *Journal of Ecology*. 102(4): pp.1025–1037.

¹⁴ Ong JE. 1993. Mangroves – a carbon source or sink. *Chemosphere*. 27(6): pp.1097–1107.

¹⁵ These national studies include: (1) Abd. Rahman AR et al. 2015. *Laporan Analisis Petak Kajian Tumbesaran Di Hutan Simpanan Kekal Semenanjung Malaysia (1992–2013)*. Jabatan Perhutanan Semenanjung Malaysia; (2) Tangah J, Bajau FE, Jilimin W, Baba S, Chan HT and Kezuka M. 2015. *Rehabilitation of Mangroves in Sabah: The SFD-ISME Collaboration (2011–2014)*. Sabah Forestry Department, International Society for Mangrove Ecosystems and Tokio Marine & Nichido Fire Insurance Co. Ltd.; (3) Forest Management Plan for Pin-Supu Forest Reserve, 2015; (4) High conservation values (1–4) in Ulu Kalumpang-Wullersdorf Forest Management Unit; High conservation values in Pin-Supu Forest Reserve. 2015. In: *Assessment Report and Management Recommendations*. Compiled by Nilus R, Chung AYC and Sugau JB. Sabah Forestry Department; and (5) Pearce KG. 2007. *Model Forest Management Area (MFMA) – Phase III*. Sarawak Forest Department. ITTO Project PD12/09 Rev.4(F). 275 pp. See also footnote 12 above.

¹⁶ Brown S. 1997. *Estimating Biomass and Biomass Change of Tropical Forests: A Primer*. FAO Forestry Paper 134. Rome: Food and Agriculture Organization of the United Nations.

21. The LULUCF experts conclude that the data and information provided in the technical annex are consistent with those provided for the FRL and can be considered complete. However, the LULUCF experts note that the data and information provided were only partly transparent (see paras. 15, 19 and 20 above). The LULUCF experts propose some areas for improvement which Malaysia could consider in order to enhance the transparency and accuracy of its estimates of REDD-plus results in future submissions (see also chapter II.B.4 below).

3. Consistency with the guidelines for elements to be included in the technical annex

22. Malaysia provided data and information on all the elements according to the guidelines contained in the annex to decision 14/CP.19, namely: summary information from the final report containing the assessed FRL; results in tonnes of CO₂ equivalent per year consistent with the assessed FRL; a demonstration that the methodologies used to produce the results are consistent with those used to establish the assessed FRL (as outlined in chapter II.B.1 above); a description of the forest monitoring system and the institutional roles and responsibilities for measuring, reporting and verifying the results; necessary information that allows for the reconstruction of the results (as outlined in chapter II.B.2 above); and a description of how the elements contained in decision 4/CP.15, paragraph 1(c) and (d), have been taken into account.

23. Referring to decision 14/CP.19, annex, paragraph 2, Malaysia provided a summary of the results per year from the implementation of the activity sustainable management of forests for the years 2006–2010 in table 1 of its technical annex, which is consistent with the assessed FRL. The results amount to total removals of 97.47 Mt CO₂ eq for the five years covered.

24. In response to a question by the LULUCF experts relating to decision 14/CP.19, annex, paragraph 1(d), Malaysia clarified that the date of the FRL submission was 8 December 2014, followed by a modified submission made on 24 September 2015, and the date of the final technical assessment report was 17 December 2015 (see para. 3 above).

25. The LULUCF experts note that Malaysia provided a description of its National Forest Monitoring System (NFMS) and a summary of the institutional roles and responsibilities for the measurement, reporting and verification (MRV) of the results in the technical annex, as required by decision 14/CP.19, annex, paragraph 4. The roles and responsibilities of the agencies and institutions involved in MRV are transparently provided. Malaysia integrated a remote sensing application into forest monitoring in 2008. The forest monitoring system using remote sensing (FMRS) was developed in several phases by the Malaysian Remote Sensing Agency and the Forestry Department of Peninsular Malaysia. The monitoring system covered the PRF, which amounted to 14.5 M ha in 2010 or 81 per cent of the total forest area. The objective of the system is to enhance the effectiveness of the monitoring of forest resources, including logging activities. The FMRS may also hold the potential to estimate forest degradation. The LULUCF experts acknowledge this information shared by Malaysia.

26. The LULUCF experts note that the majority of the information provided under the description of the NFMS is not directly related to the activity data used for the calculation of emissions and removals from sustainable management of forests; for example, the harvested volume is obtained from the National Commodity Statistic Reports (see footnote 10 above) and the area of production forest is obtained from the State Executive Council's approval on areas that are gazetted and degazetted for each year.

27. According to decision 11/CP.19, paragraph 4(b), the NFMS should enable the assessment of different types of forest in the country, including natural forest. During the consultation process, Malaysia explained that, currently, changes in the areas of three

different natural forest types (in production and protection forests inside the PRF and in the protected areas outside the PRF) are monitored. Forest types inside stateland forest are not assessed. Malaysia further clarified that forest plantations have recently come under the jurisdiction of the Forestry Department to ensure that the areas continue to be protected as forests. Malaysia further clarified that some degraded forests have been converted to plantation forests since 1990 and gazetted over time as PRF; however, only natural forest inside PRF was considered in the FRL and results calculation. The LULUCF experts note that Malaysia's modified FRL submission provides forest area statistics as the sum of PRF production forest, PRF conservation forest and stateland forest. Therefore, if plantation forest is not included in the PRF production forest (which is part of the activity data for the calculation of removals; see para. 15 above) it is not clear whether and how this area of plantation forest is included in the forest statistics. The LULUCF experts therefore note that including separate production and area statistics for plantation forest would enhance transparency.

28. The LULUCF experts observed that the proposed FRL does not cover the entire forest area within the national territory because not all forest areas are subject to sustainable management of forests. In reference to decision 1/CP.16, paragraph 71(c), footnote 7, the subnational monitoring and reporting should include: monitoring and reporting of emissions displacement at the national level, if appropriate, and reporting on how displacement of emissions is being addressed; and on the means to integrate subnational monitoring systems into a national monitoring system. In terms of monitoring and reporting of emissions displacement at the national level, the LULUCF experts note the following:

(a) Malaysia provided information on the total forest area change from 1990 to 2012 in table 17 of the modified FRL submission, which suggests a net loss of forest area during the FRL period and a net increase in forest area during the REDD-plus results reporting period. The LULUCF experts also looked at other available sources of information, namely tree cover data provided by the University of Maryland,¹⁷ and noted an upward trend in tree cover loss which is contrary to the trend from Malaysia's data in its modified FRL submission. However, the LULUCF experts also noted that the tree cover data from the University of Maryland include an extensive area outside the forest; specifically, at the 30 per cent cover threshold, tree cover was reported at 29 M ha in 2000, whereas Malaysia's forest area was reported as 18 M ha in 2000. In addition, in the years 2013 and 2014 tree cover loss inside plantations was 329,000 ha and 490,000 ha, respectively, according to the World Resources Institute¹⁸ and as such the upward trend in tree cover loss could be a result of increased harvesting in tree plantations outside forest. The LULUCF experts therefore note that there is no evidence of displacement of emissions from the activity sustainable management of forests towards the activity of deforestation;

(b) In response to a question from the LULUCF experts regarding whether the reduction in commercial harvesting may have resulted in an increase in logging activities outside the PRF as such increasing emissions from the activity of forest degradation, Malaysia explained that the total commercial harvest did not increase and the approved annual allowable cut was not fully utilized. Despite the moratorium in some States on logging activity in the PRF since 2008, there is no evidence of increased logging activity outside the PRF. The LULUCF experts looked at available information, namely the total national roundwood production data from the Food and Agriculture Organization of the

¹⁷ 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(6160): pp.850–853. Data can be viewed at <<http://earthenginepartners.appspot.com/science-2013-global-forest>>.

¹⁸ <<http://www.globalforestwatch.org/country/MYS>>.

United Nations Statistics Division (FAOSTAT)¹⁹ and found that the average industrial roundwood production in the period 2006–2010 decreased by 24 per cent compared with the average production in the period 1992–2005, and the average fuelwood production in the period 2006–2010 decreased by 15 per cent compared with the average production in the period 1992–2005. Based on this available information, the LULUCF experts note that there is no evidence of displacement of emissions from the activity sustainable management of forests towards the activity of forest degradation.

29. Malaysia provided a description of how the Intergovernmental Panel on Climate Change (IPCC) guidance and guidelines were taken into account, in accordance with paragraph 1(c) of decision 4/CP.15. For the estimation of emissions and removals in production forests inside the PRF, Malaysia used the gain–loss methodology provided in the 2006 IPCC Guidelines for estimation of emissions associated with commercial wood harvest and removals associated with net forest regrowth.

4. Accuracy of the results in the technical annex

30. The results for inland forest from Malaysia's NFI suggest a net growth rate of 9.3 t DM per ha per year or 9.57 t DM per ha per year without subtracting mortality. These values are high compared with IPCC default values, as noted in the technical assessment report of the FRL, but they are in line with findings by Banin et al. (2014)²⁰ from 11 plots in North Borneo that suggest an above-ground wood production of 9.73 ± 0.56 Mg dry matter per ha per year for dipterocarp forests. Moreover, the above-mentioned study by Banin et al. covered undisturbed forests, whereas Malaysia's NFI results are from data obtained from managed forest with harvesting, where growth may be higher. Malaysia further clarified that, according to scientific studies,²¹ the forests in Malaysia are recovering from a past disturbance potentially linked to climatic factors.

31. In response to a question raised by the LULUCF experts, Malaysia clarified that above-ground biomass was, on average, lower for NFI cycle 4 (2002) compared with NFI cycle 3 (1992) and NFI cycle 5 (2012) and the reduction of growing stock observed in NFI cycle 4 was due to effects from El Niño of 1997–1998. Malaysia further clarified that, owing to the increased mortality after El Niño and the subsequent canopy cover opening, the regrowth for this period was above average. At the same time, the increased mortality of larger trees caused by El Niño has been considered through the mortality rate of standing and fallen dead trees in NFI cycles 4 and 5. Nonetheless, the cumulative net removals over the FRL and REDD-plus results period is 264 t CO₂ eq/ha for inland forest (1992–2010), which seems high given that these removals are from growth in forest land remaining forest land. The LULUCF experts therefore reiterate the finding contained in paragraph 16 of the report on the technical assessment of Malaysia's proposed FRL (see para. 20 and footnote 8 above), which suggests that the effect of saturation of the biomass carbon pool should be considered when calculating net increments of subsequent rotation cycles.

¹⁹ <<http://www.fao.org/faostat/en/#data/FO>>.

²⁰ See footnote 13 above.

²¹ These scientific studies include: (1) Morley RJ and Flenley JR. 1987. Late Cainozoic vegetational and environmental changes in the Malaya Archipelago. In: TC Whitmore (ed.). *Biogeographical Evolution of the Malay Archipelago. Oxford Monographs on Biogeography 4*. Oxford Scientific Publications. pp.50–59; (2) Chave J, Condit R, Muller-Landau HC, Thomas SC, Ashton PS and Bunyavejchewin S. 2008. Assessing evidence for a pervasive alteration in tropical tree communities. *Plods Biol.* 6(3): e45. Available at <<https://doi.org/10.1371/journal.pbio.0060045>>; and (3) Ashton PS, Okuda T and Manokaran N. 2003. Pasoh Research: Past and Present. In: T Okuda, N Manokaran, Y Matsumoto, K Niiyama, SC Thomas and PS Ashton (eds.). *Pasoh – Ecology of a Lowland Rain Forest in Southeast Asia*. Tokyo: Springer-Verlag. pp.1–13.

32. In the calculation of removals, Malaysia uniformly applied a growth rate (different per forest type) to the full production forest area (see para. 19 above). According to the information provided in the technical annex, this growth rate corresponds to the biomass increment for forest logged between 1 and 30 years measured in the NFI. The NFI measurements suggest that after 30 years, there is a significant decline in biomass increment to 4.3 t/ha/year. Following a question by the LULUCF experts as to whether Malaysia therefore assumes all production forest to have been logged over the past 30 years, Malaysia clarified that approximately 90 per cent of the production forests have been logged within the 25–30 year harvesting cycle. The LULUCF experts therefore note that the uniform application of the growth rate to the entire production forest area within the PRF may somewhat overestimate removals for the approximately 10 per cent which was logged more than 30 years ago.

33. The LULUCF experts note that Malaysia calculated biomass in the plots by multiplying biomass at the midpoint of the diameter class by the total number of trees per diameter class, which eliminates information on the variability of tree volume within the class. Malaysia explained that this procedure was developed for the first two NFI cycles and maintained for reasons of consistency and comparability between NFI cycles. Nonetheless, the LULUCF experts note that a direct comparison of the sum of biomass calculated per individual tree is expected to result in more accurate results.

34. The LULUCF experts note that Malaysia did not provide information about the uncertainty of the activity data, emission and removal factors and the overall uncertainty of the results. Based on the possible over- and underestimations referred to in paragraphs 31–33 above, the LULUCF experts conclude that the results are partly accurate.

35. The LULUCF experts note that the estimation of results from the implementation of the activity sustainable management of forests in the production forest of the PRF of Malaysia has been undertaken using a consistent but partly transparent approach. Malaysia noted that it will harmonize its NFI among the three regions of the country (Peninsular Malaysia, Sabah and Sarawak) by 2022 to provide data that will improve the methods and accuracy of estimates. The LULUCF experts commend Malaysia for the significant long-term efforts in building up a robust NFMS and its efforts for improvements which are being implemented and are expected to enhance the transparency of estimates of emissions and removals from the activity sustainable management of forests.

C. Areas identified for technical improvement

36. The LULUCF experts conclude that some of the areas for technical improvement identified in the report on the technical assessment of Malaysia's proposed FRL²² also apply to the reporting of REDD-plus results in the technical annex of Malaysia's first BUR submission. The LULUCF experts also recognize that the implementation of some of these areas for technical improvement may be subject to the availability of adequate and predictable support for their implementation, including the following:

(a) Verification of applied biomass increment rates with complete data sets taken from NFI cycles corresponding to a representative period. Specifically, the LULUCF experts note that not all NFI cycles have been considered (i.e. cycle 3 has not be considered because a different sampling design and methodology was used) and the ones considered (cycles 4 and 5) may have atypical growth rates owing to El Niño (see para. 31 above) and not all individual tree measurements are used in the biomass calculation at the plot level (see paras. 32 and 33 above);

²² FCCC/TAR/2015/MYS, in particular paragraphs 35 and 36.

(b) Revision of estimates by replacing the single value biomass conversion and expansion factors (BCEF) applicable to wood removals ($BCEF_R$) with forest type specific $BCEF_R$ as suggested in the report on the technical assessment of Malaysia's proposed FRL²³ or by replacing the single value BCEF with values obtained through direct field measurements in the country;

(c) Provision of uncertainty estimates of emission and removal factors and activity data as well as overall uncertainties of the emission reduction estimates, as encouraged by decision 17/CP.8, annex, paragraph 24;

(d) Treatment of emissions from deforestation (see paras. 38 and 42 below).

37. Furthermore, the LULUCF experts identified the following additional areas for technical improvement:

(a) Provision of a more transparent description of how the increase in production forest area inside the PRF results in an increase of removals in the REDD-plus results calculation and a description of the full set of assumptions underlying this calculation (see para. 15 above). This may include the collection of data indicating that the growth rate (ΔC_G) is higher when forests are gazetted as PRF production forest, and/or mortality and extraction rates (ΔC_L) in such forests are lower as a result of gazettelement to PRF production forest, because sustainable management is undertaken in these forests as compared with stateland forests, which can be legally deforested;

(b) Consideration of the use of NFI-specific data, including data from remeasurements in permanent sample plots for Peninsular Malaysia and the East Malaysian States Sabah and Sarawak, and the stratification of these regions according to forest type by the FMRS to differentiate growth rates between forest types and regions in order to improve the accuracy of the estimation of the FRL and the results of REDD-plus in the future. Malaysia could also consider including additional measurements to estimate mortality. (see paras. 19 and 20 above);

(c) Provision of information on types of extracted species and location of extraction, even if approximate, from around 5 M ha certified forest (around 40 per cent of production forest) to facilitate a more complete estimation of emissions and removals as a result of forest management;

(d) Consideration of undertaking a direct comparison of biomass in the repeated plot measurements rather than a multiplication of midpoint values with number of trees (see para. 33 above);

(e) Disaggregation of natural forest and plantation forest in the provision of area and production statistics (see para. 27 above).

D. Comments and/or responses by the Party concerned

38. During the consultation process, Malaysia noted that its FMRS needs to be enhanced and the associated technology needs to be cost-effective. The identification and integration of the potential cost-effective technology into the FMRS could be an area for capacity-building. Increasing knowledge of NFI analysis may increase the accuracy of the assessment of emissions and removals from the activity sustainable management of forests. Additional data from stateland forests could provide a better analysis of time series data and hence could enable Malaysia to include the activity reducing emissions from deforestation.

²³ FCCC/TAR/2015/MYS, paragraph 20(e).

In addition, increasing resources would enable combining high-resolution imagery and field measurements to detect changes in canopy cover structure, which could enable Malaysia to include the activity “reducing emissions from forest degradation” in future FREL/FRL submissions and estimation and reporting of REDD-plus results.

III. Conclusions

39. The LULUCF experts conclude that Malaysia has reported results from the implementation of one activity, sustainable management of forests, applied in the production forest inside the PRF which consisted of 73 and 70 per cent of the total forest area of Malaysia for the years 2006 and 2010, respectively. The results include estimates of emissions and removals of CO₂ from two carbon pools: above-ground and below-ground biomass. The results of the activity were reported using consistent methodologies, definitions, assumptions and information as used for the assessed FRL.

40. The LULUCF experts consider that the data and information provided in the technical annex are consistent, complete, partly transparent (see para. 21 above) and partly accurate (see para. 34 above).

41. As far as can be assessed by the LULUCF experts, based on the available information and on the assumptions used, the results are partly accurate. The LULUCF experts note that the growth rate may be considered high compared with IPCC default values (see para. 30 above) and note that the increase in removals in the calculation of results is due to an increase in the area of production forest (see paras. 14 and 15 above). The LULUCF experts also note that the emission estimates per cubic metre for commercial harvest might be considered low. As such, some assumptions may overestimate while other assumptions may underestimate emission reductions, but there are no indications that the results reported by Malaysia are systematically overestimated.

42. The LULUCF experts note that, at present, information on forest area change in the modified FRL submission and additional information on national roundwood production from FAOSTAT do not provide any evidence of displacement. The LULUCF experts commend Malaysia for enhancing its forest monitoring system through the use of remote sensing (FMRS), which may allow the country to estimate deforestation and, potentially, forest degradation, on a national scale.

43. In conclusion, the LULUCF experts commend Malaysia for showing a strong commitment to continuous improvement of its data and information used for producing results, in line with a stepwise approach, which are consistent with those used to establish its assessed FRL. The LULUCF experts also acknowledge that the TA process was an opportunity for a facilitative and constructive technical exchange of views and information with Malaysia.²⁴ Some areas for future technical improvements have been identified in this report (see paras. 36–37 above). At the same time, the LULUCF experts acknowledge that these improvements are subject to national capabilities and circumstances, and note the importance of adequate and predictable support.²⁵

²⁴ Decision 14/CP.19, paragraphs 12 and 13.

²⁵ Decision 2/CP.17, paragraph 57.

Annex

Technical annex to the biennial update report

Owing to the complexity and length of the submitted technical annex¹ to the biennial update report and in order to maintain the original formatting, the technical annex is not reproduced here. It can be downloaded from the UNFCCC website at <<http://unfccc.int/8722>>.

¹ Annexed to the BUR as “Technical Annex 2: Seeking to obtain and receive payments for REDD+ results-based actions (Decision 14/CP.19).”