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**Technical report on the technical analysis of the technical annex to the first biennial update report of Mozambique submitted in accordance with decision 14/CP.19, paragraph 7, on 20 December 2022**

*Summary*

This technical report covers the technical analysis of the technical annex submitted on a voluntary basis, in the context of results-based payments, by Mozambique on 20 December 2022 through its first biennial update report in accordance with decision 14/CP.19. The technical annex provides data and information on the activity reducing emissions from deforestation, which is an activity included in decision 1/CP.16, paragraph 70, and covers the same national territorial forest area as the assessed forest reference emission level (FREL) proposed by Mozambique in its modified FREL submission of May 2018.

Mozambique reported the results of implementing this activity for 2014–2016, which amount to 78,809,278 tonnes of carbon dioxide equivalent and were measured against the assessed FREL of 38,956,426 tonnes of carbon dioxide equivalent per year.

The data and information provided in the technical annex are in overall accordance with the guidelines contained in decision 14/CP.19, annex. The technical analysis concluded that the data and information provided by Mozambique in the technical annex are mostly transparent and fully consistent with the data and information used for establishing the assessed FREL in accordance with decision 1/CP.16, paragraph 71(b), and decision 12/CP.17, section II. This report contains the findings from the technical analysis and a few areas identified for capacity-building and future technical improvement in accordance with decision 14/CP.19, paragraph 14.



## Abbreviations and acronyms

2006 IPCC Guidelines	<i>2006 IPCC Guidelines for National Greenhouse Gas Inventories</i>
AD	activity data
BUR	biennial update report
CO <sub>2</sub>	carbon dioxide
CO <sub>2</sub> eq	carbon dioxide equivalent
EF	emission factor
FREL	forest reference emission level
GHG	greenhouse gas
IPCC	Intergovernmental Panel on Climate Change
LULUCF	land use, land-use change and forestry
MRV	measurement, reporting and verification
NFI	national forest inventory
NFMS	national forest monitoring system
PSP	permanent sampling plot
REDD+	reducing emissions from deforestation; reducing emissions from forest degradation; conservation of forest carbon stocks; sustainable management of forests; and enhancement of forest carbon stocks (decision 1/CP.16, para. 70)
TA	technical analysis
TTE	team of technical experts

## I. Introduction, overview and summary

### A. Introduction

1. This technical report covers the TA of the technical annex provided by Mozambique on 20 December 2022 in accordance with decision 14/CP.19, paragraph 7, included in its first BUR, which was submitted in accordance with decision 2/CP.17, paragraph 41(a), and annex III, paragraph 19. In the technical annex, Mozambique provided the data and information used for estimating its anthropogenic forest-related emissions by sources and removals by sinks, forest carbon stocks, and changes in forest carbon stock and forest area resulting from implementing REDD+ activities. The submission of the technical annex is voluntary and in the context of results-based payments in accordance with decision 14/CP.19, paragraph 8. The TA was coordinated by Luca Birigazzi (secretariat).

2. In this context, Mozambique underlined that the submission of the technical annex through its first BUR does not modify, revise or adjust in any way the nationally appropriate mitigation actions voluntarily submitted by the Party under the Bali Action Plan, nor does it interfere with its nationally determined contribution under the Paris Agreement.

3. The TA of the technical annex is part of the international consultation and analysis of BURs referred to in decision 2/CP.17, annex IV, paragraph 4, the objective of which is to increase the transparency of mitigation actions and their effects through analysis by the TTE in consultation with Mozambique and through a facilitative sharing of views, resulting in a separate summary report.<sup>1</sup>

4. Mozambique made its first FREL submission, in accordance with decision 12/CP.17, on 10 January 2018, which was subject to a technical assessment following the guidance provided in decision 13/CP.19 and its annex. The latest assessed FREL was included as one of the elements of the technical annex to its first BUR in accordance with the guidelines contained in decision 14/CP.19, annex. The findings from the technical assessment of the FREL are included in a separate report.<sup>2</sup>

### B. Process overview

5. The TA of the first BUR of Mozambique took place from 19 to 23 June 2023 as a desk analysis 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: Jacob Amoako (Ghana), Reza Fallah (Islamic Republic of Iran), Henrik Fliflet (Norway), Kokou Jérémie Fontodji (Togo), Reitumetse Molotsoane (South Africa), Mame Coumba Ndiaye (Senegal), Sekai Ngarize (Zimbabwe), Maxence Rageade (France), Mauro Meirelles de Oliveira Santos (Brazil) and Alexander Zahar (Australia). Henrik Fliflet and Sekai Ngarize were the LULUCF experts who undertook the TA of the technical annex in accordance with decision 14/CP.19, paragraphs 10–13.

6. The TA of the technical annex provided by Mozambique was undertaken in accordance with the procedures contained in decisions 2/CP.17, 14/CP.19 and 20/CP.19. This technical report on the TA was prepared by the LULUCF experts in the TTE in accordance with decision 14/CP.19, paragraph 14.

7. During the TA and subsequent exchanges, the LULUCF experts and Mozambique engaged in technical discussions, and Mozambique provided clarifications in response to questions raised by the LULUCF experts, in order to reach an understanding on the identification of the capacity-building needs of the Party and areas for future technical improvement.

8. Following the TA of the technical annex, the LULUCF experts prepared and shared the draft technical report with Mozambique for its review and comments. The LULUCF

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<sup>1</sup> FCCC/SBI/ICA/2023/TASR.1/MOZ.

<sup>2</sup> FCCC/TAR/2018/MOZ, published on 20 November 2018.

experts responded to the Party's comments and incorporated them into and finalized this technical report in consultation with Mozambique.

### **C. Summary of results**

9. 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 in accordance with its respective capabilities and national circumstances. In the context of results-based payments and in line with decision 12/CP.17, Mozambique, on a voluntary basis, proposed a national FREL covering the activity reducing emissions from deforestation for the purpose of a technical assessment in accordance with decision 13/CP.19 and its annex. The activity is being implemented in Mozambique's national territory. The assessed FREL of Mozambique is 38,956,426 t CO<sub>2</sub> eq/year.

10. The Party's FREL is based on its annual average historical CO<sub>2</sub> emissions associated with reducing emissions from deforestation for the historical reference period 2003–2013. Mozambique reported the results of implementing the activity for 2014–2016, calculated against the FREL, which amount to emission reductions of 78,809,278 t CO<sub>2</sub> eq for 2014–2016, comprising 22,360,120 t CO<sub>2</sub> eq in 2014, 25,738,689 t CO<sub>2</sub> eq in 2015 and 30,710,470 t CO<sub>2</sub> eq in 2016.

## **II. Technical analysis of the information reported in the technical annex**

### **A. Technical annex**

11. For the technical annex to the first BUR submitted by Mozambique, see annex I.<sup>3</sup>

### **B. Technical analysis**

12. 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) The methodologies, definitions, comprehensiveness and information provided are consistent between the assessed FREL and the results of implementing REDD+ 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 decision 14/CP.19, paragraph 9;

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

13. The remainder of this chapter presents the results of the TA of the technical annex to the Party's first BUR according to the scope outlined in paragraph 12 above.

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

14. In accordance with decision 14/CP.19, paragraph 3, the data and information used by a Party for estimating its anthropogenic forest-related emissions by sources and removals by sinks, forest carbon stocks, and changes in forest carbon stock and forest area resulting from implementing REDD+ activities should be transparent and consistent over time and with the data and information used for establishing its FREL in accordance with decision 1/CP.16, paragraph 71(b–c), and decision 12/CP.17, section II.

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<sup>3</sup> As per decision 14/CP.19, para. 14(a).

15. The LULUCF experts noted that Mozambique ensured overall consistency between its assessed FREL and estimated results of implementing the activity reducing emissions from deforestation in 2014–2016 by:

(a) Using consistent methodologies and data to generate AD on deforestation. Mozambique generated AD for the FREL and the REDD+ technical annex during the same exercise using the same forest monitoring system with consistent methodologies, forest type stratification, data and definitions. The AD were obtained from the visual interpretation of annual historical time series of high- and medium-resolution remote sensing imagery, using the Open Foris Collect Earth tool;

(b) Using consistent methodologies and data to derive EFs from the NFI conducted between 2015 and 2017, and regional allometric equations considered appropriate for miombo woodlands (semi-deciduous forest including miombo) and IPCC default values for above- and below-ground biomass for mangrove forest, cropland and grassland;

(c) Covering the same two carbon pools: above- and below-ground biomass;

(d) Covering the same gas: CO<sub>2</sub>;

(e) Covering the same area: the entire national territory;

(f) Consistently applying the same assumptions, such as considering temporary forest loss, for example due to clear-cutting for charcoal production, as deforestation;

(g) Using the same forest definition (minimum area 1 ha, minimum height 3 m and minimum 30 per cent canopy cover).

16. During the TA, Mozambique confirmed that AD on deforestation for 2014–2016 were generated during the production of AD on deforestation for 2001–2016, as used for the FREL. A subset of the data produced from 2001 to 2016 was filtered to generate the FREL for 2003–2013, while the remaining data were used to calculate annual emissions for 2014–2016, taking into consideration the FREL. Consequently, the methodology employed to generate AD for both periods is the same and AD for 2014–2016 were not generated in independent monitoring exercises.

17. In view of the above, the LULUCF experts concluded that the results presented of implementing the activity reducing emissions from deforestation are fully consistent with the assessed FREL. The LULUCF experts commend Mozambique for ensuring consistency of data and methodologies between the FREL submission for the historical reference period 2003–2013 and the technical annex with the results of implementing the activity reducing emissions from deforestation for 2014–2016.

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

18. The LULUCF experts noted that Mozambique did not provide sufficient information in the technical annex to allow for reconstruction of the results, for example applied equations and formulae in both main text and calculation worksheets, and a land-use change matrix. During the TA process, however, Mozambique provided additional information, including information on the network of PSPs, a land-use transition matrix for 2014–2016, references to publications used as sources for national and regional allometric equations used to generate EFs, an uncertainty analysis of annual emissions and emission reductions per forest stratum, and access to the Excel spreadsheets used to calculate the results (see annex III for the full list of documents).

19. During the TA, Mozambique demonstrated each step in the calculation of the results, including the generation of AD from remote sensing sample plots, the generation of EFs from the NFI, the calculation of the FREL and results and the estimation of uncertainties through error propagation. The LULUCF experts commend Mozambique for its exemplary efforts, transparent sharing of information and quick responses during the TA process to increase the

transparency and ensure the completeness<sup>4</sup> of the data and information provided, thus allowing for reconstruction of the results.

20. The LULUCF experts note that Mozambique could enhance the transparency and ensure the completeness of the data and information used for estimating the results by making available the requested information on the website of the Party's MRV unit for REDD+.<sup>5</sup>

21. According to decision 12/CP.17, paragraph 8, the FREL shall be established taking into account decision 4/CP.15, paragraph 7, and maintaining consistency with the anthropogenic forest-related GHG emissions by sources and removals by sinks reported in the Party's GHG inventory. The team assessing Mozambique's FREL noted that the Party did not maintain consistency in terms of sources of AD and EFs with those used for the GHG inventory included in its first national communication.<sup>6</sup> The Party's first BUR includes an updated GHG inventory for 2016, but does not include sufficient information on how consistency between the GHG inventory and the results was ensured. During the TA, Mozambique clarified that consistency has improved because the same AD and EFs were used for estimating the FREL and results and the LULUCF inventory. The LULUCF experts suggest that Mozambique improve the transparency of future FREL and results submissions by providing a description of how consistency with the GHG inventory was ensured.

22. The LULUCF experts noted that the AD used for constructing the FREL and estimating the results were consistent. Spatially explicit observations of land-cover change over time, used as a proxy for land-use categories and conversions, were derived from a 4 x 4 km sampling grid systematically distributed across the national territory. Mozambique clarified that the AD used to estimate both the FREL and the results were generated from a single analysis of data for 2001–2016, conducted in 2017.

23. During the TA, Mozambique informed the LULUCF experts that a methodology for estimating forest degradation by monitoring changes in forest type in forest land remaining forest land has been developed and is under consideration for use for the next FREL submission.

24. It is noted in the report on the technical assessment of the proposed FREL that the method of AD generation may classify temporary loss of tree cover as deforestation. In response to a question from the LULUCF experts, Mozambique elaborated on the significance of this bias, explaining that the classification of temporary loss of tree cover as deforestation occurs mainly for areas of intense and increasing charcoal production, which is limited to the provinces of Gaza and Maputo, where clear-cutting of forest for charcoal production is classified as conversion to grassland. Mozambique provided an estimate of the absolute potential impact of this bias, and the LULUCF experts find the impact, applied consistently across the FREL and the results, to be insignificant for the results period.

25. During the TA, Mozambique explained that appropriately classifying temporary forest cover loss remains a priority for the MRV unit. However, the methodology under development for estimating forest degradation is not expected to include monitoring of emissions from temporary loss of forest cover. Mozambique informed the LULUCF experts that accurately classifying forest and cropland land-use changes in the context of shifting agriculture is an area of capacity-building need. The LULUCF experts note that Mozambique may consider following the IPCC guidance on the 20-year default transition period when classifying land-use transitions.

26. The LULUCF experts noted that the EFs used in constructing the FREL and estimating the results are consistent. The same biomass values and the same five aggregated forest strata and 14 underlying forest types were used for both. The NFI conducted between 2015 and 2017 was used to derive biomass estimates and EFs for four of the forest strata, while IPCC defaults were used for mangrove forest. A combination of IPCC allometric equations and nationally developed and regionally relevant allometric equations were used to estimate tree level biomass.

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<sup>4</sup> "Complete" here means including the information necessary for reconstructing the results.

<sup>5</sup> <https://www.fnds.gov.mz/mrv/index.php/documentos/outros-documentos> (in Portuguese).

<sup>6</sup> Available at <https://unfccc.int/documents/128110>.

27. During the TA, Mozambique shared the allometric equations applied and references to relevant publications and additional information on the applicability of regional equations (see annex III). Specifically, the Mugasha et al. (2013) allometric equation for estimating biomass was applied for some deciduous forest species to derive the EFs for the largest forest strata in the country. The Party outlined that the equation is currently the best option for estimating tree biomass in Mozambique since comparable national equations involve greater uncertainty. The Party highlighted that the species, floristic composition, species distribution and growing conditions of the miombo woodland sites used in Mugasha et al. closely resemble miombo woodlands in Mozambique. The LULUCF experts commend Mozambique for providing transparent information and suggest including references and the justification for the applicability of regional equations in future FREL submissions.

28. During the TA, Mozambique highlighted the consistent overestimation of emissions stemming from the use of IPCC default values for post-conversion carbon stocks of grassland, since the post-conversion ecosystem in Mozambique would be more accurately classified as shrubland or savannah woodland with an expected higher carbon stock. Similarly, using IPCC default values for cropland (defaults were applied only for perennial crops) may result in underestimating the post-conversion carbon stock of Mozambique's cropland under shifting cultivation. The LULUCF experts commend Mozambique for transparently highlighting this issue and suggest including it as an area for future technical improvement.

29. Mozambique did not consider regrowth after deforestation in estimating its FREL or results. Immediate loss of above- and below-ground carbon stocks was assumed at the time of conversion, resulting in estimates of gross deforestation.

30. In response to a question from the LULUCF experts, Mozambique clarified that an uncertainty assessment of the results was conducted following the same approach used for the FREL. Mozambique shared the results of the uncertainty analysis for both AD and EFs, and for both annual emissions and total emission reductions, following the error propagation approach described in the 2006 IPCC Guidelines (vol. 1, chap. 3, section 3.2.3). The LULUCF experts commend Mozambique for sharing this information, and suggest including information on the estimation of uncertainties, directly or referenced via weblinks, in future FREL submissions.

31. The LULUCF experts note that the error propagation approach adopted assumes no correlation between the variables – in the case of Mozambique, the above- and below-ground biomass carbon pools – but that a degree of correlation between the pools is to be expected due to mutual dependence. The LULUCF experts suggest improving the uncertainty analysis by removing the effect of correlation of variables as a potential area for improvement for future FREL submissions.

32. A potential area for improvement noted in the report on the technical assessment of the proposed FREL is using higher-tier approaches to improve the calculation of uncertainties. During the TA, Mozambique informed the LULUCF experts that the emission reduction reports under the Forest Carbon Partnership Facility Zambézia Integrated Landscape Management Program include Monte Carlo simulations used to estimate uncertainties, and that it is considering whether to apply error propagation or Monte Carlo simulations for its calculations for future FREL submissions.

33. Another potential area for improvement noted in the report on the technical assessment of the proposed FREL is updating the EFs for different strata using data from the national PSP network. During the TA, Mozambique provided additional information on the establishment of the national PSP network and the data it produces. Mozambique clarified that the PSP network is not expected to replace the temporary plots used in NFIs. Additionally, while the data produced by the PSP network are instrumental in providing data relevant for the management of forest concessions (growth rates, mortality, regeneration), it is not expected to be a key source for the development of EFs. Mozambique underlined the high costs of maintaining the PSP network. Between 2019 and 2022, 25 PSPs were established in Mozambique, but remeasurements of trees have yet to take place. More

information on the PSPs of Mozambique can be found on the MRV unit website.<sup>7</sup> The LULUCF experts commend Mozambique for the clarification and for sharing information on the ongoing improvements in forest management.

34. The LULUCF experts concluded that Mozambique provided the information necessary for reconstructing the results of implementing the activity reducing emissions from deforestation. The data and information provided in the technical annex are considered to be mostly transparent, fully consistent, mostly complete and mostly accurate to the extent possible.

### **3. Consistency with the guidelines on elements to be included in the technical annex**

35. Mozambique provided data and information on all the required elements that are, overall, in accordance with the guidelines contained in decision 14/CP.19, annex, namely summary information from the final report containing the assessed FREL; results in t CO<sub>2</sub> eq/year consistent with the assessed FREL; a demonstration that the methodologies used to produce the results are consistent with those used to establish the assessed FREL (as outlined in chap. II.B.1 above); a description of the forest monitoring system and institutional roles and responsibilities in MRV of the results; the information necessary for reconstructing the results (as outlined in chap. II.B.2 above); and a description of how the elements contained in decision 4/CP.15, paragraph 1(c–d), have been taken into account.

36. Mozambique provided a summary table with the results of implementing the activity reducing emissions from deforestation for 2014–2016, which are consistent with the assessed FREL. The emission reductions achieved are listed in table 15 of the technical annex and amount to 78,809,278 t CO<sub>2</sub> eq for 2014–2016.

37. The LULUCF experts noted that Mozambique provided a description of the NFMS and a transparent summary of the roles and responsibilities of the agencies and institutions involved in MRV of the results in the technical annex, together with weblinks for accessing further information. During the consultation process, Mozambique explained that the NFMS has been enhanced since 2021 to enable the monitoring of most of the policies and measures for sustainable forest management.

38. The forest monitoring system is a national system covering the entire national territory of Mozambique. The roles and responsibilities of each agency in the system are clearly explained in the technical annex and in the additional NFMS document referenced in the submission. The agencies share responsibility for operating and improving the NFMS. The system includes a combination of remote sensing and ground-based forest inventories and surveys and has three main components: satellite and land monitoring, the NFI and the national GHG inventory.

39. The system uses a satellite land monitoring system to generate AD and information on forest area and loss and provides information on land use or land cover. Since 2017, Mozambique has produced spatial data and information on land-use or land-cover change, including annual national deforestation data, using mainly satellite images. The NFMS provides information on the effect of policies and measures for addressing the drivers of deforestation, and it includes a database and data management system for data related to forest and forestry. The combined use of field data, the NFI and remote sensing enables the Party to generate information, in particular on forest land, for its GHG inventories.

40. 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. Mozambique uses geographical information systems to monitor forests in each region, thereby facilitating detailed mapping by forest type and region. The generation of detailed disaggregated data supports the detection of deforestation in monitored areas. During the consultation process, Mozambique explained that the NFI is carried out every 10 years and enables the Party to continue to update biomass values and revise associated parameters by forest type and EF, consequently facilitating more accurate estimates of biomass. Mozambique indicated that the litter, deadwood and soil organic carbon pools are expected to be included in future NFIs.

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<sup>7</sup> <https://bit.ly/localizacaoPAPsMOZ> (in Portuguese).



41. On the basis of the available information, the LULUCF experts noted that, so far, there is no evidence of displacement of emissions.

42. Mozambique provided a description of how IPCC guidance and guidelines were taken into account in accordance with decision 4/CP.15, paragraph 1(c). For estimating emission reductions for forest land and forest-related land conversions, Mozambique used the methodology provided in the 2006 IPCC Guidelines for estimating the carbon stocks of forest land converted to other land uses. Accordingly, emissions from deforestation were estimated for 2014–2016 by combining AD (i.e. areas of annual deforestation) with the appropriate EF (i.e. emissions associated with the corresponding forest type).

43. In constructing its FREL and estimating the results, Mozambique covered the most significant pools, and no non-CO<sub>2</sub> GHGs were included. Overall, the exclusion of the soil organic carbon pool and non-CO<sub>2</sub> gases was adequately justified. During the TA, Mozambique informed the LULUCF experts that there is technical capacity to monitor non-CO<sub>2</sub> emissions from biomass burning, a potential area for improvement mentioned in the report on the technical assessment of the proposed FREL. There are insufficient resources, however, to develop and operationalize such monitoring. Additionally, Mozambique informed the LULUCF experts that the collection of data on soil organic carbon and dead organic matter is expected to be included in the next NFI. The LULUCF experts commend Mozambique for its intention to obtain better information on soil organic carbon and non-CO<sub>2</sub> gases with the aim of including them in future FRELS and estimates of results as part of the stepwise approach.

#### **4. Accuracy of the results proposed in the technical annex**

44. The LULUCF experts noted that the Party estimated the results of implementing the activity reducing emissions from deforestation in the national territory using a mostly transparent and fully consistent approach. They commend Mozambique for its significant long-term efforts to build up a robust NFMS that is capable of providing transparent estimates of emissions from deforestation.

45. Both the established FREL and the results obtained for 2014–2016 from implementing the activity reducing emissions from deforestation are based on consistently applied assumptions, or biases with negligible impact (see paras. 24–25 above), and the definition of deforestation is consistent between the FREL reference period and the results period.

46. The LULUCF experts noted that no conversion of natural forest to forest plantation was reported. During the consultation process, Mozambique stated that the conversion of natural forest to forest plantation is not expected to have occurred in the country and that quantifying this type of transition was not the primary objective during the reported monitoring period. Furthermore, according to the survey protocol used to assess land use and land-use changes, this transition was considered forest land remaining forest land and there was no record of it. However, in the future, the transition is expected to be considered forest degradation.

47. As mentioned in paragraphs 25, 28 and 31 above, Mozambique provided some information related to accuracy. The LULUCF experts noted that the technical annex does not contain information on how the uncertainty analysis was conducted to produce the uncertainty estimates for the results. During the consultation process, Mozambique provided some information related to uncertainties for the carbon stock changes associated with land conversion from forest land to non-forest land. The uncertainties of AD and EFs were established through sampling distribution. The overall uncertainty was propagated using the error propagation equation provided in the 2006 IPCC Guidelines (see also para. 30 above). In order to enhance transparency of reporting, the LULUCF experts suggest that Mozambique provide information on how the uncertainty analysis was conducted in the technical annex.

### C. Areas identified for future technical improvement

48. The LULUCF experts concluded that the following areas for future technical improvement identified in the report on the technical assessment of Mozambique's FREL also apply to the provision of information on the results of implementing the activity reducing emissions from deforestation:

- (a) Estimating and applying country-specific carbon stocks for post-deforestation land uses (see para. 28 above);
- (b) Including in the estimation subsequent removals from post-deforestation land;
- (c) Allowing the division of sample units into two or more forest types instead of considering only the dominant type;
- (d) Monitoring and excluding temporarily cleared forest from the assessment of deforestation for future FRELs, and possibly including in the FREL emissions and removals from areas under forest degradation (see paras. 24–25 above);
- (e) Improving consistency between the GHG inventory and the FREL submission (see para. 21 above);
- (f) Improving the calculation of uncertainties by using higher-tier approaches (see para.31 32 above);
- (g) Monitoring non-CO<sub>2</sub> emissions from biomass burning and, if found to be significant, including them in future FRELs (see para. 43 above);
- (h) Collecting and analysing data on soil organic carbon and, if deemed significant, potentially including that pool in the FREL (see para. 43 above).

49. Furthermore, the LULUCF experts noted that Mozambique could consider:

- (a) Increasing the transparency of future results submissions by including or referencing via functioning weblinks additional information that allows for reconstruction of the results; for example, applied equations and formulae in both main text and calculation worksheets, and a land-use change matrix (see paras. 18–20, 30 and 47 above);
- (b) Monitoring and reporting the conversion of natural forest to plantation forest and associated uncertainties in future FREL and results submissions (see para. 46 above);
- (c) Improving the uncertainty analysis (when applying the error propagation approach) by removing the effect of correlation of variables (see para. 31 above).

### D. Comments and responses of the Party

50. During the consultation process, Mozambique noted a number of areas of capacity-building needs. Addressing those needs could enable Mozambique to improve its data and methodologies and include additional activities and gases in future FREL submissions. After exchanges with the LULUCF experts, Mozambique identified as a capacity-building need accurately classifying forest and cropland land-use changes in the context of shifting agriculture (see para. 25 above).

## III. Conclusions

51. The LULUCF experts conclude that Mozambique reported the results of implementing the activity reducing emissions from deforestation, which is defined as the anthropogenic conversion of natural forest to non-forest land. Mozambique generated AD for the FREL and technical annex during the same exercise, using the same forest monitoring system with consistent methodologies, forest type stratification, data and definitions. AD were obtained from the visual interpretation of annual historical time series of high- and medium-resolution remote sensing imagery, using the Open Foris Collect Earth tool. EFs were derived from the NFI using regional allometric equations and IPCC default values for estimating above- and below-ground biomass for forest, cropland and grassland. The results

include emissions of CO<sub>2</sub>. The results of the activity were estimated and reported using methodologies, definitions, assumptions and information that are consistent with those used for constructing the assessed FREL.

52. The LULUCF experts consider the data and information provided in the technical annex to be mostly transparent, fully consistent, mostly complete and mostly accurate (see in particular paras. 18, 20, 21, 25, 27, 28, 30 and 31 above).

53. The LULUCF experts find the data and information provided in the technical annex to be fully consistent with the guidelines referred to in decision 14/CP.19, paragraph 9.

54. The results are mostly accurate to the extent possible based on the assumptions used (see in particular paras. 25, 28, 31, 46 and 47 above).

55. In conclusion, the LULUCF experts commend Mozambique for showing strong commitment to continuously improving the data and information used for calculating the results, in line with the stepwise approach, which are consistent with those used for constructing its assessed FREL. Some areas for future technical improvement and capacity-building needs identified by Mozambique have been identified in this report. At the same time, the LULUCF experts acknowledge that such improvements are subject to national capabilities and circumstances, and note the importance of adequate and predictable support.<sup>8</sup> The LULUCF experts also acknowledge that the TA process was an opportunity for a facilitative and constructive technical exchange of views and information with Mozambique.<sup>9</sup>

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<sup>8</sup> As per decision 2/CP.17, para. 57.

<sup>9</sup> As per decision 14/CP.19, paras. 12–13.

## **Annex I**

### **Technical annex to the biennial update report**

Owing to the complexity and length of the submitted technical annex to the BUR, and in order to maintain the original formatting, the technical annex has not been reproduced here. It is available at <https://unfccc.int/BURs>.

## Annex II

### Summary of the main features of the reported results of implementing the activities referred to in decision 1/CP.16, paragraph 70, based on information provided by Mozambique

	<i>Key elements</i>	<i>Remarks</i>
Results reported	78 809 278 t CO <sub>2</sub> eq	Presented as the amount of emission reductions for 2014–2016 (see para. 10 of this document)
Results period	2014–2016	See paragraph 10 of this document
Assessed FREL	38 956 426 t CO <sub>2</sub> eq/year	Based on annual average historical CO <sub>2</sub> emissions during the reference period. See document FCCC/TAR/2018/MOZ for details. See also the modified version of the proposed FREL set out in the report of Mozambique submitted on 28 May 2018 <sup>a</sup> See paragraph 9 of this document
Reference period	2003–2013	See paragraph 10 of this document
National/subnational	National	See paragraph 9 of this document
Activity included	Reducing emissions from deforestation	The FREL and the results were based on deforestation activity. Emissions that occurred were associated with land-use changes from forest land to other land uses (see para. 9 of this document)
Pools included	Above-ground biomass Below-ground biomass	See paragraph 15 of this document
Gas included	CO <sub>2</sub>	See paragraph 15 of this document
Consistency with assessed FREL	Methods, definitions, and information used for the assessed FREL are consistent with those used for the results	Consistent parameters, land-use maps and estimation equations were applied for both the assessed FREL and the results (see paras. 14–17 of this document)
Description of NFMS and institutional roles	Included	See paragraphs 37–40 of this document
Identification of future technical improvements	Included	Several areas for future technical improvement have been identified (see paras. 48–49 of this document)

<sup>a</sup> Available at <https://redd.unfccc.int/submissions.html?country=moz>.

## Annex III

### Reference documents

#### A. Reports of the Intergovernmental Panel on Climate Change

IPCC. 2006. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. S Eggleston, L Buendia, K Miwa, et al. (eds.). Hayama, Japan: Institute for Global Environmental Strategies. Available at <http://www.ipcc-nggip.iges.or.jp/public/2006gl>.

#### B. UNFCCC documents

First modified FREL submission of Mozambique. Available at [https://redd.unfccc.int/files/moz\\_frel\\_report\\_final.v03\\_03102018.pdf](https://redd.unfccc.int/files/moz_frel_report_final.v03_03102018.pdf).

“Guidelines and procedures for the technical assessment of submissions from Parties on proposed forest reference emission levels and/or forest reference levels”. Decision 13/CP.19, annex. Available at <https://unfccc.int/sites/default/files/resource/docs/2013/cop19/eng/10a01.pdf#page=36>.

“Guidelines for submissions of information on reference levels”. Decision 12/CP.17, annex. Available at <https://unfccc.int/sites/default/files/resource/docs/2011/cop17/eng/09a02.pdf#page=19>.

Report on the technical assessment of the proposed FREL of Mozambique submitted in 2018. FCCC/TAR/2018/MOZ. Available at [https://unfccc.int/sites/default/files/resource/tar2017\\_MOZ.pdf](https://unfccc.int/sites/default/files/resource/tar2017_MOZ.pdf).

#### C. Other documents

The following references may not conform to UNFCCC editorial style as some have been reproduced as received or as cited in the submission:

JICA. 2017. The project for the establishment of sustainable forest resource information platform for monitoring REDD+ in the Republic of Mozambique. Maputo. Mozambique: Japan International Cooperation Agency.

Magalhães TM. 2015a. Allometric equations for estimating belowground biomass of *Androstachys johnsonii* Prain. *Carbon Balance and Management*. 10(1): pp.16.

Magalhães TM. 2015b. Live above- and belowground biomass of a Mozambican evergreen forest: a comparison of estimates based on regression equations and biomass expansion factors. *Forest Ecosystems*. 2(1): pp.28.

Mate R, Johansson T and Siteo A. 2014. Biomass Equations for Tropical Forest Tree Species in Mozambique. *Forests*. 5(3): pp.535–556.

MITADER. 2016. Designing and implementing an accuracy assessment of a change map and estimating area based on the reference sample data. República de Moçambique, Ministério da Terra, Ambiente e Desenvolvimento Rural.

MITADER. 2018. Inventário Florestal Nacional. Maputo: República de Moçambique, Ministério da Terra, Ambiente e Desenvolvimento Rural.

MITADER. 2020. Manual para a Instalação e Monitoria de Parcelas de Amostragem Permanentes. Maputo: República de Moçambique, Ministério da Terra, Ambiente e Desenvolvimento Rural.

Mugasha WA, Eid T, Bollandsås OM, et al. 2013. Allometric models for prediction of above- and belowground biomass of trees in the miombo woodlands of Tanzania. *Forest Ecology and Management*. 310: pp.87–101.

Excel spreadsheets used to calculate FREL for the years 2003-2013.

Excel spreadsheets used to calculate results of implementing the activity "reduced emissions from deforestation" for 2014-2016.

Land use transition matrix for the results period 2014-2016.

List of Policies and Measures for National Forest Monitoring System.

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