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Report on the technical assessment of the proposed forest reference emission levels and forest reference level of the Sudan submitted in 2025

Summary

This report covers the technical assessment of the voluntary submission of the Sudan on its proposed forest reference emission levels (FRELs) and forest reference level (FRL) in accordance with decision 13/CP.19 and in the context of results-based payments. The FRELs and FRL proposed by the Sudan cover the activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks respectively, which are among the activities included in paragraph 70 of decision 1/CP.16.

For its submission, the Sudan developed a national FREL and FRL. The FREL and FRL presented in the original submission, based on the reference period 2012–2021, correspond to 6,932,496 tonnes of carbon dioxide equivalent (t CO_2 eq) per year and –2,108,584 t CO_2 eq/year respectively. As a result of the facilitative process during the technical assessment, the FREL for reducing emissions from deforestation was modified to 9,317,358 t CO_2 eq/year, the FRL for enhancement of forest carbon stocks was modified to –2,112,017 t CO_2 eq/year and a FREL of 1,678,433 t CO_2 eq/year was included for reducing emissions from forest degradation.

The assessment team notes that the data and information used by the Sudan in constructing its FRELs and FRL are mostly transparent, complete and mostly in accordance with the guidelines contained in the annex to decision 12/CP.17. This report contains information on the assessed FRELs and FRL and a few areas identified by the assessment team for future technical improvement in accordance with the provisions on the scope of the technical assessment contained in the annex to decision 13/CP.19.

Abbreviations and acronyms

2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*
2019 Refinement to the 2006 IPCC Guidelines	*2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*
AD	activity data
AGB	above-ground biomass
AR	afforestation and reforestation
AT	assessment team
BUR	biennial update report
CH_4	methane
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
COP	Conference of the Parties
EF	emission factor
FAO	Food and Agriculture Organization of the United Nations
FNC	Forests National Corporation of the Sudan
FREL	forest reference emission level
FRL	forest reference level
GHG	greenhouse gas
IPCC	Intergovernmental Panel on Climate Change
MAI	mean annual increment
N_2O	nitrous oxide
NC	national communication
NFI	national forest inventory
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)
SOC	soil organic carbon
TA	technical assessment

I. Introduction and summary

A. Overview

1. This report covers the TA of the submission of the Sudan on its proposed FREL and FRL,[1] submitted on 17 January 2025, in accordance with decisions 12/CP.17 and 13/CP.19. The TA took place from 24 to 28 March 2025 and was coordinated by the secretariat.[2] The TA was conducted by the AT, consisting of two land use, land-use change and forestry experts from the UNFCCC roster of experts:[3] Javier Fernandez (Democratic Republic of the Congo) and Amanda Thomson (United Kingdom of Great Britain and Northern Ireland). The TA was coordinated by Keiichi Igarashi (secretariat).

2. In response to the invitation of the COP and in accordance with the provisions of paragraphs 7–15 of and the annex to decision 12/CP.17, the Sudan submitted its proposed FREL and FRL on a voluntary basis. The proposed FREL and FRL are among the elements[4] to be developed in implementing the activities referred to in paragraph 70 of decision 1/CP.16. Pursuant to paragraphs 1–2 of decision 13/CP.19 and paragraphs 7–8 of decision 14/CP.19, the COP decided that each submission of a proposed FREL and/or FRL, as referred to in paragraph 13 of decision 12/CP.17, shall be subject to a TA in the context of results-based payments.

3. The objective of the TA is to assess the degree to which the information provided by the Sudan is in accordance with the guidelines for submissions of information on reference levels[5] and to offer a facilitative, non-intrusive, technical exchange of information on the construction of the FREL and FRL with a view to supporting the capacity of the Sudan to construct and improve its FREL and FRL in the future, as appropriate.[6]

4. The TA of the FREL and FRL submitted by the Sudan was undertaken in accordance with the guidelines and procedures for the TA of submissions from Parties on proposed FRELs and/or FRLs.[7] This report on the TA was prepared by the AT following the same guidelines and procedures.

5. Following the process set out in those guidelines and procedures, a draft version of this report was communicated to the Government of the Sudan. The facilitative exchange during the TA allowed the Sudan to provide clarifications and additional information, which were considered by the AT in preparing this report.[8] As a result of the facilitative interactions with the AT during the TA, the Sudan provided a modified version of its submission on 2 June 2025, which took into consideration the technical input of the AT. The modifications, which improved the clarity and transparency of the submission, resulted in the update of the FREL for reducing emissions from deforestation and the FRL for enhancement of forest carbon stocks, and the inclusion of a FREL for reducing emissions from forest degradation. This TA report was prepared in the context of the modified FREL and FRL submission.

B. Proposed forest reference emission levels and forest reference level

6. In paragraph 70 of decision 1/CP.16, the COP 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 providing adequate and predictable support. The FRELs and FRL proposed by the Sudan, on a voluntary basis for a TA in the context of results-based payments, cover the activities reducing emissions from deforestation, reducing

[1] The submission of the Sudan is available at https://redd.unfccc.int/submissions.html?country=sdn.
[2] As per decision 13/CP.19, annex, para. 7.
[3] As per decision 13/CP.19, annex, paras. 7 and 9.
[4] See decision 1/CP.16, para. 71(b).
[5] Decision 12/CP.17, annex.
[6] Decision 13/CP.19, annex, para. 1(a–b).
[7] Decision 13/CP.19, annex.
[8] As per decision 13/CP.19, annex, paras. 1(b), 13 and 14.

emissions from forest degradation and enhancement of forest carbon stocks respectively, which are three of the five activities referred to in paragraph 70 of decision 1/CP.16. The FREL for reducing emissions from deforestation covers emissions from deforestation associated with conversion of forest land, assumes that the total forest carbon stock is lost at the time of conversion and excludes any subsequent CO_2 emissions and removals (i.e. it is for gross deforestation). The FREL for reducing emissions from forest degradation covers emissions from loss of biomass carbon stocks in forest land and assumes that forest carbon stocks are reduced in proportion to the loss of tree canopy cover. The FRL covers CO_2 removals resulting from activities under the national AR programme managed by FNC and local communities. For its submission, the Sudan applied a stepwise approach to developing its FRELs and FRL in accordance with paragraph 10 of decision 12/CP.17, which enables Parties to improve their FRELs and FRLs by incorporating better data, improved methodologies and, where appropriate, additional pools.

7. The national FRELs and FRL submitted by the Sudan in the modified submission correspond to 9,317,358 t CO_2 eq/year for reducing emissions from deforestation, 1,678,433 t CO_2 eq/year for reducing emissions from forest degradation and –2,112,017 t CO_2 eq/year for enhancement of forest carbon stocks based on the reference period 2012–2021.[9] The table contained in annex I summarizes the main features of the FRELs and FRL presented in the modified submission, with the aim of accessing results-based payments for REDD+ activities, including reference period, territorial coverage, and pools and gases included.

8. For constructing its FRELs and FRL, the Sudan used the 2006 IPCC Guidelines and the 2019 Refinement to the 2006 IPCC Guidelines. Emissions from deforestation were calculated as the net average annual carbon stock changes associated with forest land converted to non-forest land (mainly cropland), disaggregated by State, applying equations 2.15 and 2.16 of the 2006 IPCC Guidelines. Emissions from forest degradation were calculated as the average relative reduction in biomass carbon stocks before and after forest degradation in each State, based on the reduction in tree canopy cover as measured through Collect Earth. Removals from enhancement of forest carbon stocks were estimated as the average annual accumulated CO_2 removals from AR activities on cropland and bare land in degraded forest areas (mainly subjected to cultivation), applying equations 2.9 and 2.10 of the 2006 IPCC Guidelines. Annual removals were further disaggregated by State and by AR implemented with seeds and seedlings separately.

9. For estimating AD for deforestation, the Sudan used an FAO-developed stratified area estimate approach (FAO, 2016) and its NFI systematic sampling grid. The grid comprises 1,755 sampling units, for 784 of which there are field measurements, and covers the entire national territory. The five ecosystem strata in the NFI sampling design were defined according to climatic, ecological and geographical criteria. For the purpose of estimating areas of deforestation, the sampling was intensified for strata III and IV given that 97.4 per cent of the country's forests are found in these strata. Forest probability maps were used to further stratify strata III and IV according to low, medium and high probability of forest change. The forest probability maps were created using the System for Earth Observation Data Access, Processing and Analysis for Land Monitoring, a cloud computing platform developed by FAO. Finally, intensified sampling (of 7,558 samples) through Collect Earth using visual interpretations of forest and non-forest probability maps was conducted on strata III and IV.

10. For estimating AD for forest degradation, the Sudan identified all areas of stable forest with evidence of tree loss observed as a reduction in tree canopy cover. Tree canopy cover after a degradation event was recorded while gathering data through Collect Earth. The Sudan then calculated the average reduction in tree canopy cover per State for 2012–2021.

11. For estimating AD for AR, the Sudan used records of AR activities under the national AR programme managed by FNC, which are kept at FNC headquarters and State offices.

[9] In its original submission, the Sudan proposed a FREL of 6,932,496 t CO_2 eq/year for reducing emissions from deforestation and a FRL of –2,108,584 t CO_2 eq/year for enhancement of forest carbon stocks. The difference between the original and the modified submission is due mostly to recalculations as a result of parameter errors and the inclusion of the activity reducing emissions from forest degradation.

FNC conducts site supervision visits to assess the success of AR plantations. The data and information are archived at FNC State offices. AD for AR are divided between AR areas planted with seeds and those with seedlings, given that the success rate for tree plantations planted with seedlings is much higher. FNC conducts site inspections and assesses the success of tree plantations one, two or three years after planting. The Sudan used expert judgment to define success rates over the historical reference period by State for areas planted with seeds and seedlings, taking into consideration tree species rotations.

12. For estimating EFs for deforestation, the Sudan used its NFI in conjunction with its 2023 forest probability map and Global Ecosystem Dynamics Investigation data to develop a national model for predicting pixel-level AGB. Owing to the inaccessibility of several sample units during fieldwork for security or physical reasons, the Sudan was unable to complete its on-the-ground NFI and opted to use ancillary remote-sensing information to predict AGB across its national territory. The model enhances and spatializes the NFI data, keeping estimates within the range of measured values.

13. For estimating EFs for forest degradation, the Sudan assumed that changes in tree canopy cover were equal to changes in AGB carbon stocks, thereby establishing a 1:1 linear ratio between tree canopy cover and AGB. The EFs for forest degradation were estimated by multiplying the percentage of tree canopy cover loss by the pre-degradation, stable forest AGB stock associated with each State.

14. For estimating removal factors for enhancement of forest carbon stocks, the Sudan selected default MAI values for productive semi-natural forests from the 2019 Refinement to the 2006 IPCC Guidelines. Wood density values were obtained from scientific literature, World Agroforestry, the African Wood Density Database and other sources listed in annex 2 to the modified FREL and FRL submission. Root-to-shoot ratio, carbon fractions and biomass expansion factors were obtained from the 2019 Refinement to the 2006 IPCC Guidelines, the 2006 IPCC Guidelines and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*.

15. The FRELs and FRL proposed by the Sudan are its second such reference levels submitted in the context of applying the stepwise approach. The previous subnational FRL was submitted on 16 January 2020 and was subject to a TA in 2021; it covered the activities reducing emissions from deforestation and enhancement of forest carbon stocks based on the reference period 2006–2018, corresponding to 1,223,286 t CO_2 eq/year and –288,229 t CO_2 eq/year respectively, which are lower than the national FRELs and FRL proposed for those activities in the Sudan's most recent submission (see finding ID# 14 in the table below for differences between the most recent FRELs and FRL and the previous FRL).

16. Uncertainties were estimated using approach 1 of the 2006 IPCC Guidelines for error propagation and reported in the FREL and FRL submission. The uncertainty estimates reported represent the 90 per cent confidence interval. According to the modified submission, the uncertainty reported for reducing emissions from deforestation is 13 per cent, while for reducing emissions from forest degradation it is 17 per cent. For enhancement of forest carbon stocks, the uncertainty estimates include EFs only, as obtained from the 2006 IPCC Guidelines and the 2019 Refinement to the 2006 IPCC Guidelines. AD uncertainty was not estimated as it was obtained from government records.

II. Technical assessment of the proposed forest reference emission levels and forest reference level

17. The table below describes the findings from the TA of the data, methodologies and procedures used by the developing country Party under assessment in constructing its FRELs and FRL within the scope of the TA in accordance with decision 13/CP.19 and its annex.

Findings from the technical assessment of the data, methodologies and procedures used by the developing country Party under assessment in constructing its forest reference emission level and/or forest reference level

Finding ID#	*Aspect of the scope of the TA (decision 13/CP.19, annex, para. 2)*	*Description of the issue, additional information shared by the Party during the TA and conclusion of the AT*	*Area for future technical improvement*
1	2(a) Consistency with the national GHG inventories	The AT noted that the Sudan submitted its NC3 and first BUR, including an updated national GHG inventory, on 13 April 2025, during this TA. Overall, the AT noted that the Sudan applied the 2006 IPCC Guidelines for its updated national GHG inventory and for the current FRELs and FRL. However, due to the level of detail presented in both the NC3 and first BUR, it was not possible for the AT to assess whether consistency was maintained. During the TA, the Sudan explained that consistency was maintained in terms of the use of the 2006 IPCC Guidelines; however, the Sudan acknowledges the need to further improve the consistency of the AD and EFs. The AT commends the Sudan for updating its national GHG inventory as part of preparing its NC3 and first BUR. While noting that, according to the modified submission, the Sudan achieved such consistency, the AT was unable to confirm consistency with the national GHG inventory.	The AT notes that clearly documenting how consistency with the national GHG inventory is maintained is an area for future technical improvement of the FRELs and FRL.
2	2(c) AD – accuracy	The Sudan used records from FNC to report AD for AR activities. These records include reports from State offices on AR activities including supervision visits conducted by FNC officers, which, according to the Sudan, may occur one, two or even three years after tree planting. During the TA, the Sudan explained that sampling of AR forests was conducted using Collect Earth, but the resolution of the satellite imagery available was insufficient to observe younger plantations. As a result, the Sudan relied on expert judgment to determine success rates of the annual AR areas planted with seeds and seedlings for tree plantations by State. The AT notes that, according to the Sudan's modified submission, the rotation cycle for planting can extend up to 40 years. The AT also notes that, once the supervision visits stop, there is no continuous monitoring of success rates and stocking density of the AR areas, including whether plantations remain on site. The AT is of the view that the Sudan may wish to establish a method for the continuous monitoring of the areas of enhancement of forest carbon stocks across the national territory, which would also support the validation, currently based on expert judgment, of the success rates of AR tree plantations over time.	The AT notes that continuous monitoring of the AR areas over time is an area for future technical improvement that would increase the accuracy of the FRL estimates.
3	2(c) AD – accuracy	The Sudan defined the activity enhancement of forest carbon stocks as an AR activity carried out under the national AR programme managed by FNC and local communities. The AT consulted the Sudan to clarify whether tree plantations established prior to the beginning of the historical reference period (2012–2021) were also included, since they may still have been present (and growing) during the FRL historical reference period. During the TA, the Sudan confirmed that AR areas established prior to the historical reference period are not considered in the FRL, and that the FRL is calculated as a historical average including only removals accumulated in AR areas actually planted during the reference period.	

Finding ID#	*Aspect of the scope of the TA (decision 13/CP.19, annex, para. 2)*	*Description of the issue, additional information shared by the Party during the TA and conclusion of the AT*	*Area for future technical improvement*
		This approach is similar to that used for the FREL for reducing emissions from deforestation, which includes only emissions resulting from deforestation occurring during the reference period. The Sudan further explained that a similar discussion on the inclusion of AR areas planted prior to the reference period took place during the TA of its 2020 FRL submission. While the Sudan initially included removals from AR areas planted prior to the reference period in its original submission, it revised this approach following technical exchanges with the AT at that time, and subsequently considered only removals from AR activities implemented during the reference period (see para. 31 of document FCCC/TAR/2020/SDN). The AT notes that, as defined by the Sudan, there are areas where the activity enhancement of forest carbon stocks is taking place but are not considered in the FRL.	
4	2(c) AD – accuracy	To estimate AD for deforestation, the Sudan intensified the sampling using its NFI grid for strata III and IV, which together comprise 97.4 per cent of the country's forests. Although forests are also present in strata II and V to a lesser extent, the AT noted that deforestation in strata II and V was sampled at lower intensity. During the TA, the Sudan explained that the sampling intensity selected for stratum V produced a result suggesting that the area of deforestation for that stratum was equivalent to the total forest area. Furthermore, the Sudan confirmed that forests in stratum V are affected by agricultural expansion. The AT notes that the sampling error associated with the deforestation area in stratum V is likely to be high due to the geographical characteristics of the stratum and the lower sampling intensity than for other forest strata. Consequently, the AT considered that the Sudan may wish to ensure consistent treatment of all deforestation areas in terms of sampling intensity across the country for future FREL and FRL submissions. In the modified submission, the Sudan enhanced its NFI data with Global Ecosystem Dynamics Investigation data by developing a national model for predicting pixel-level AGB, effectively covering all forest areas. The modelled AGB estimates are within the range of the NFI data. The AT notes that this approach is in line with the IPCC guidance and guidelines and commends the Sudan for its efforts.	
5	2(c) AD – transparency	The Sudan reported that most of its deforestation is related to forest land converted to cropland and that the conversion of forest land to other land uses is rare and therefore considered insignificant. During the TA, the AT suggested that reporting AD for deforestation disaggregated by IPCC land-use category (i.e. forest land converted to cropland, grassland, wetland, settlements and other land) could enhance transparency, noting that this would be feasible using the land-use data collected by the Sudan through Collect Earth. In the modified submission (table 12), the Sudan included a breakdown of areas of forest loss including final land use for 2011–2023. However, the values provided were not annual estimates in accordance with the 2006 IPCC Guidelines.	

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		The AT considers that reporting annual areas of forest land conversion, including final land use, could enhance the transparency of future FREL submissions. Further, the AT notes that annual reporting of AD on forest land converted to other land uses would also contribute to improved consistency with the national GHG inventory, in line with the IPCC guidelines and guidance. This could further support the Sudan in improving consistency over time, as per decision 12/CP.17.	
6	2(c) EFs – transparency and completeness	The Sudan reported data disaggregated by State on average forest volume per hectare for AGB and standing deadwood (table 15 of the original submission), weighted average wood density by State (table 16) and the values used for root-to-shoot ratio and carbon fraction. This information was combined to derive the EFs (in t CO_2/ha) for deforestation by State (table 17). Wood densities for tree species present in the Sudan are provided in annex 2 to the submission. During the TA, the Sudan provided an additional spreadsheet detailing the calculation of EFs for deforestation and a breakdown of the most common tree species in each State (representing over 80 per cent of the total wood volume by State) used to calculate the weighted average wood density. The AT considered that providing a flow chart and/or equations detailing the EF calculation steps, along with clear references for data sources and parameters such as specific tables, IPCC default values or other sources, would improve transparency and enable the FREL to be reconstructed. Such information should be provided for each carbon pool considered (e.g. AGB, below-ground biomass and standing deadwood). In the modified submission, the Sudan included the equations used for calculating the deforestation EFs for AGB, below-ground biomass and standing deadwood with references for data sources and parameters. The AT commends the Sudan for its efforts. There remain some minor areas where transparency could be improved in the submission report (not the calculations themselves), as the units in the equations on pages 57–58 and 71 of the modified submission are inconsistent within and between equations.	The AT considers applying quality control procedures to ensure that the units included in the submission are consistent within and between equations to be an area for future technical improvement.
7	2(c) EFs – accuracy	Concerning the development of EFs for enhancement of forest carbon stocks, the Sudan reported State-level information based on FNC AD records and IPCC default data since country-specific annual growth rates for tree species used in AR are not available from the NFI or other national sources. Representative default MAI values were taken from table 4.11 of the 2019 Refinement to the 2006 IPCC Guidelines, reflecting growth rates for relevant native tree species under the continent Africa. Two exceptions are the MAI value for *Azadirachta indica*, which is obtained from FAO data, and the MAI value for *Dalbergia sissoo*, which is obtained from under the region/country China rather than from the general values listed in table 4.11 of the 2019 Refinement to the 2006 IPCC Guidelines. During the TA, the Sudan clarified that the China-specific MAI value for *Dalbergia sissoo*[a] was lower than the default value and more appropriate for the Sudan's growth conditions. Table 20 of the original submission lists the MAI values and other parameters used to estimate removals from AR activities, including wood density values (taken from sources listed in annex 2 to the	

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		submission), root-to-shoot ratio (from table 4.4 of the 2019 Refinement to the 2006 IPCC Guidelines), carbon fractions (from table 4.3 of the 2006 IPCC Guidelines) and biomass expansion factors (from table 3A.1.10 of the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*). During the TA, the AT identified inconsistencies in the reporting of wood density values for *Sclerocarya birrea* (0.8 t dry matter/m^3) and *Azadirachta indica* (0.6 t dry matter/m^3), which fall outside the ranges provided in annex 2 to the original submission (0.51–0.64 t dry matter/m^3 for *Sclerocarya birrea* and 0.65–0.90 t dry matter/m^3 for *Azadirachta indica*). The Sudan clarified that the values had been swapped in error and acknowledged that correcting these errors would affect the overall FRL value. For the modified submission, the Sudan corrected the errors in the wood density values used for calculating the EFs for enhancement of forest carbon stocks.	
8	2(c) EFs – transparency	During the TA, the Sudan provided an additional spreadsheet outlining the calculation of the EFs for enhancement of forest carbon stocks. The calculations were based on a weighted average annual increment of merchantable volume per hectare, derived from the combination of tree species composition and the percentage of their respective areas within the AR programme for each State. The AT considered that the Sudan could improve transparency and enable the FRL to be reconstructed by including in its submission a flow chart and/or equations detailing the EF calculation steps, the weighting methodologies and the sources of data and parameters (e.g. tables, IPCC default values or other sources). Such information should be clearly presented for each carbon pool covered (e.g. AGB, below-ground biomass and standing deadwood). In the modified submission, the Sudan included equations describing the EF calculation steps, weighting and sources of data and parameters for biomass carbon stock change. The AT commends the Sudan for the additional information provided, which increases the transparency of the submission.	
9	2(c) EFs – accuracy	For estimating CO_2 removals in AR areas, the Sudan employed tier 1 default values from the 2006 IPCC Guidelines and the 2019 Refinement to the 2006 IPCC Guidelines. During the TA, the AT consulted the Sudan on the application of removal factors for the activity enhancement of forest carbon stocks. The Sudan explained that it assumes the selected tier 1 removal factors to be representative of the entire rotation period for the tree species used, which is typically 30–40 years. The AT is of the view that, considering the activity enhancement of forest carbon stocks is a significant activity, the Sudan may wish to collect data to enable tier 2 estimation and reporting, following IPCC guidance, subject to sufficient and additional support.	The AT notes that collecting tree growth data in AR areas to enable tier 2 reporting for the activity enhancement of forest carbon stocks is an area for future technical improvement of the FRL.
10	2(c) Approaches – transparency	In its modified submission, the Sudan reported uncertainty estimates for both FRELs (reducing emissions from deforestation and reducing emissions from forest degradation). However, a	The AT notes that providing an estimate of uncertainty for the

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		propagated uncertainty estimate was not provided for the FRL (enhancement of forest carbon stocks). During the TA, the Sudan explained that a propagated uncertainty estimate was not provided for the FRL as the AD were obtained from government records (FNC) and because the associated default EFs were obtained from the 2006 IPCC Guidelines and the 2019 Refinement to the 2006 IPCC Guidelines. The AT commends the Sudan for reporting uncertainty estimates (90 per cent confidence interval) for both FRELs and is of the view that uncertainty relating to the AD for AR areas may be determined through expert judgment with the assistance of remote sensing. Such uncertainty estimates for AD can be propagated with the reported uncertainty for the selected EFs as reported by the IPCC, and using the appropriate IPCC approach, to develop an uncertainty estimate for the FRL.	activity enhancement of forest carbon stocks is an area for future technical improvement that would increase the transparency of the FRL submission.
11	2(c) Approaches – transparency	Pursuant to paragraph 10 of the annex to decision 12/CP.17, the Sudan developed a national FREL for reducing emissions from deforestation, a national FREL for reducing emissions from forest degradation and a national FRL for enhancement of forest carbon stocks. The FRELs were subdivided according to the 13 and 12 States respectively where deforestation and forest degradation occurred during the historical reference period (2012–2021), while the FRL was subdivided according to the 18 States where AR activities occurred during the same period. For the purpose of results-based payments, the Sudan confirmed that the national-level FRELs and FRL will be used. During the TA, the Sudan explained that the State-level subdivisions are helpful for internal planning and implementation of REDD+ activities. The AT commends the Sudan for transitioning from a subnational FRL to national FRELs and FRL and takes note of the national values for the FRELs and FRL selected to serve as benchmarks for the chosen REDD+ activities.	
12	2(c) AD – accuracy	In its original submission, the Sudan excluded the activity reducing emissions from forest degradation. During the TA, the AT noted that the Sudan could use the information collected through Collect Earth to estimate tree canopy cover loss associated with forest degradation. As a result of this technical exchange, the Sudan included a national FREL for the activity reducing emissions from forest degradation as part of its modified submission, amounting to 1,678,433 t CO_2 eq/year. In its modified submission, the Sudan included information on the AD and EFs associated with forest degradation, as well as a description of the methodological approach adopted. The AT commends the Sudan for its efforts.	
13	2(d) Description of relevant policies and plans, as appropriate	The Sudan provided information in the FREL and FRL submission on its 2002 Forests and Renewable Resources Act as well as previous legislation. It referred to measures undertaken to ensure that a percentage of national land under agriculture is protected as shelter belts and protective windbreaks, and to FNC, which develops and implements policies, rules, plans and methods for safeguarding and protecting forests, including technical supervision of forest	

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		resources, building awareness and promoting AR, such as the production of gum arabic and other forest products.	
14	2(e) Changes to previously submitted FRL	In its original FREL and FRL submission, the Sudan described the following changes from previously submitted information in accordance with paragraph (b) of the annex to decision 12/CP.17: (a) The FRL was prepared at the national level, whereas the previous FRL was prepared at the subnational level, and covers all forest land and all land areas potentially available for enhancement of forest carbon stocks; (b) The national FREL and FRL are disaggregated by State, consistently with the Sudan's national institutional arrangements; the FREL for deforestation covers all 13 States with forest loss and the FRL for enhancement of forest carbon stocks covers all 18 States where there is potential for implementing AR activities, whereas the previous FRL was disaggregated by 3 States; (c) The historical reference period is 2012–2021, whereas the period for the previous FRL submission was 2006–2016; (d) Standing deadwood was included in the calculation of emissions from deforestation; (e) The estimate of removals from enhancement of forest carbon stocks was expanded from covering merchantable volume to total AGB. The Sudan included in its modified submission a table (table 27) describing changes between the reference levels submitted in 2020 and 2025 and additional changes made in the modified 2025 submission compared with the original submission. The AT concludes that the FRELs and FRL proposed in the 2025 modified submission differ from those in the modified 2020 submission previously assessed owing mainly to the transition to a national FREL and FRL, the addition of a FREL for reducing emissions from forest degradation, the different historical reference period, the inclusion of the standing deadwood pool in estimates of emissions from deforestation and changes in the EFs for enhancement of forest carbon stocks. These changes enabled the Sudan to address some areas for future technical improvement identified during the previous TA.	
15	2(f) Pools – litter, deadwood and SOC	Litter, SOC and some components of the deadwood pool were not included in the Sudan's FRELs and FRL. According to paragraph (c) of the annex to decision 12/CP.17, reasons for omitting a pool in constructing the FREL and FRL should be provided, noting that significant pools should not be excluded. The Sudan used data from its first NFI (2021), which did not include information on SOC and litter, to construct the FRELs and FRL, and indicated that no reliable national data on SOC are available. That NFI states that future cycles of the NFI should include measurements for SOC, litter and deadwood. The Sudan noted that litter is not considered a significant pool in the dryland ecosystems of the country.	The AT considers the treatment of emissions from SOC, litter and deadwood, when data are available, such as from future cycles of the NFI, to be an area for future technical improvement of the FREL and FRL submission.

Finding ID#	*Aspect of the scope of the TA (decision 13/CP.19, annex, para. 2)*	*Description of the issue, additional information shared by the Party during the TA and conclusion of the AT*	*Area for future technical improvement*
		The AT concludes that emissions from litter are likely to be insignificant and therefore their exclusion is justified. Regarding deadwood, NFI data cover standing deadwood, fallen deadwood and stumps. Stocks of standing deadwood were included in the estimation of emissions from deforestation. However, according to NFI field experts, the data on fallen deadwood and stumps were unreliable, as most fallen deadwood is collected and consumed locally as fuelwood, typically within the same year. For enhancement of forest carbon stocks, stocks of standing deadwood were considered to be zero as deadwood accumulation is not expected in young trees. The AT considers deadwood to be a potentially significant pool in the context of the Sudan's emissions from deforestation and commends the Sudan for its progress in including standing deadwood in its estimates. The Sudan excluded the fallen and stump components of the deadwood pool because of a lack of reliable data. The AT also commends the Sudan's intention to collect improved data on deadwood in future NFIs with the aim of including the other components of the pool in enhanced FREL and FRL submissions as part of the stepwise approach. The AT requested the Sudan to clarify why it omitted the SOC pool. The Sudan explained that soil data could not be collected as planned owing to limited financial resources. The AT notes that SOC is typically a significant pool in the context of disturbances such as fire, but commends the Sudan's intention to collect SOC data in future NFIs with the aim of including the pool in enhanced FREL and FRL submissions as part of the stepwise approach.	
16	2(f) Gases – CH_4 and N_2O	The Sudan included CO_2 emissions in the FRELs and FRL but did not include non-CO_2 GHGs. The Sudan stated that this approach is consistent with its latest national GHG inventory, but as the NC3 and first BUR, which include the inventory, had not yet been submitted at the time of the TA, the AT was unable to verify this. The Sudan explained that the data and country-specific parameters required to estimate non-CO_2 emissions are not currently available. The Sudan submitted its NC3 and first BUR on 13 April 2025, in which emissions of CH_4 from biomass burning and indirect emissions of N_2O from managed soils are included in the total GHG emissions. However, there is insufficient information on data sources and methodologies used in the NC3 and first BUR to assess whether the approach is consistent with the calculation of the FRELs and FRL in the modified submission.	The AT considers the treatment of non-CO_2 gases to be an area for future technical improvement of the FREL and FRL submission.
17	2(f) Activities – conservation of forest carbon stocks and sustainable management of forests	Removals in forest land, potentially relevant for the activities conservation of forest carbon stocks and sustainable management of forests, were not included in the FRELs or FRL. Pursuant to paragraph (c) of the annex to decision 12/CP.17, reasons for omitting an activity in constructing the FREL and FRL should be provided, noting that significant activities should not be excluded. In response to the AT request for clarification of the reason for omitting these activities, the Sudan referred the AT to the information provided in the original submission, highlighting that there are currently no data for assessing emissions and removals associated with these activities	The AT considers estimating removals from forests, for purposes of their inclusion or exclusion based on significance of other REDD+ activities, to be an area for future technical improvement of the FREL and FRL submission.

Finding ID#	*Aspect of the scope of the TA (decision 13/CP.19, annex, para. 2)*	*Description of the issue, additional information shared by the Party during the TA and conclusion of the AT*	*Area for future technical improvement*
		in the country. During the TA, the Sudan also explained that forest areas under management cover less than 5 per cent of the national forest area, which is also subject to deforestation and forest degradation. Further, the Party stated that these two REDD+ activities are not relevant in its national context.	
18	2(g) Definition of forest	The Sudan provided in its submission the definition of forest used in constructing its FRELs and FRL: an area of land spanning a minimum area of 0.4 ha with trees that have attained or have the potential to attain at least 2 m in height and a minimum tree canopy cover of 10 per cent. The definition includes windbreaks and/or shelter belts with a minimum width of 20 m.	
19	2(g) Definition of forest	The Sudan's definition of forest used in constructing its FRELs and FRL was not included in its reporting to FAO for the Global Forest Resources Assessment, or in the NC2 submitted in 2013. Consequently, the AT was unable to assess whether there is a difference in the definition used for constructing the FRELs and FRL. The Sudan submitted its NC3 on 13 April 2025, which allowed the AT to assess consistency with the modified FREL and FRL submission. According to the definition in the NC3 (p.40), forest has a minimum area of 0.5 ha with trees that are at least 2 m tall and minimum tree canopy cover of 10 per cent; however, the definition of forest included in the 2025 modified FREL and FRL submission (section 2) states a minimum area of 0.4 ha, which is consistent with the definition of forest used for the Sudan's NFI (2021). During the TA, the Sudan explained that the same definition of forest has been used in the FRELs and FRL, and the NC3; however, there is a mistake in the minimum area cited in the definition of forest in the NC3 and this is supposed to be 0.4 ha instead of 0.5 ha as currently written.	
20	2(h) Inclusion of future changes to policies	The Sudan did not include assumptions about future changes to domestic policies in constructing its FRELs and FRL. The FRELs and FRL submitted represent the historical average of emissions from deforestation, emissions from forest degradation and removals from enhancement of forest carbon stocks respectively, without applying an adjustment.	

[a] See https://prota.prota4u.org/protav8.asp?g=pe&p=Dalbergia%20sissoo.

III. Conclusions

18. The FRELs and FRL presented in the submission are the Sudan's second such levels.

19. The FRELs and FRL presented in the modified submission, based on the reference period 2012–2021, correspond to 9,317,358 t CO_2 eq/year for reducing emissions from deforestation, 1,678,433 t CO_2 eq/year for reducing emissions from forest degradation and –2,112,017 t CO_2 eq/year for enhancement of forest carbon stocks.

20. The AT acknowledges that the Sudan included in its FRELs and FRL the most significant activities, the most important forest types and the most significant pools in terms of emissions from forests. The AT considers that, in doing so, the Sudan followed paragraph 70 of decision 1/CP.16, on activities undertaken, and paragraph 10 of decision 12/CP.17, on applying the stepwise approach.

21. As a result of the facilitative interactions with the AT during the TA, the Sudan provided a modified submission that took into consideration the technical input of the AT. The AT notes that the transparency and completeness of the information provided were significantly improved in the modified submission and commends the Sudan for its efforts. The new information provided in the modified submission increased the reproducibility of the FREL and FRL calculations.

22. Pursuant to paragraph 3 of the annex to decision 13/CP.19, the AT identified areas for future technical improvement (see the table above).

23. The information used by the Sudan in constructing its FRELs and FRL for reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks is mostly transparent (see finding ID#s 6 and 10 in the table above), complete and mostly in accordance with the guidelines for submissions of information on reference levels (see finding ID#s 1–2, 9 and 15–17 in the table above).

24. The AT acknowledges and welcomes the Sudan's intention to:

(a) Integrate the methodology used for estimating AD used for the FREL and FRL submission into the national forest monitoring system, ensuring that the system is regularly updated to reflect changes in forest activities;

(b) Develop national definitions for all REDD+ activities to ensure uniform interpretation and monitoring, notably by including additional local factors in the definition of forest degradation beyond reduction in tree canopy cover;

(c) Improve the quality of national data on wood volume and biomass density and the collection of data on the soil carbon and deadwood pools through regular measurements on the permanent sample plots established for the first NFI;

(d) Improve the estimation of emissions from forest degradation once new and better data become available;

(e) Extend the estimation of deadwood carbon stocks and carbon stock changes to all deadwood pools and REDD+ activities once new and better data become available;

(f) Include emissions from forest fires once new and better data become available.

25. The Sudan identified the following capacity-building needs:

(a) Developing the technical and institutional capacity of the recently established measurement, reporting and verification unit to improve data generation, documentation, reporting and sharing;

(b) Support for conducting the second NFI by building on the methodologies used in the first NFI while also addressing the shortcomings associated with these methodologies.

26. In conclusion, the AT commends the Sudan for showing strong commitment to continuously improving its FREL and FRL estimates in line with the stepwise approach. A number of areas for the future technical improvement of the Sudan's FRELs and FRL have been identified in this report. At the same time, the AT acknowledges that such improvements

are subject to national capabilities and policies, and notes the importance of providing adequate and predictable support.[10] The AT also acknowledges that the TA was an opportunity for a rich, open, facilitative and constructive technical exchange of information with the Sudan.

[10] As per decisions 13/CP.19, annex, para. 1(b); and 12/CP.17, para. 10.

Annex I

Summary of the main features of the proposed forest reference emission levels and forest reference level based on information provided by the Sudan

Main features of the FRELs and FRL		*Remarks*
Proposed FRELs	9 317 358 t CO_2 eq/year (deforestation) 1 678 433 t CO_2 eq/year (forest degradation)	See paragraph 7 of this document
Proposed FRL	–2 112 017 t CO_2 eq/year	See paragraph 7 of this document
Type and reference period of FRELs and FRL	FRELs = average of historical emissions in 2012–2021 FRL = average of historical removals in 2012–2021	See paragraph 7 of this document
Application of adjustment for national circumstances	No	
National/subnational	National	See paragraph 7 of this document See also finding ID# 11 in the table in this document
Activities included	Reducing emissions from deforestation Reducing emissions from forest degradation Enhancement of forest carbon stocks	See paragraph 7 of this document
Pools included	AGB Below-ground biomass Deadwood (standing only)	See finding ID# 15 in the table in this document
Gas included	CO_2	See finding ID# 16 in the table in this document
Forest definition	Included	See finding ID#s 18–19 in the table in this document
Consistency with latest national GHG inventory	The consistency of the methods used to establish the FRELs and FRL with those used for the latest national GHG inventory (2025) could not be assessed	See finding ID# 1 in the table in this document
Description of relevant policies and plans	Included	See finding ID# 13 in the table in this document
Description of assumptions on future changes to domestic policy, if included in constructing the FRELs and FRL	Not applicable	See finding ID# 20 in the table in this document
Description of changes to previous FRL	Included	See finding ID# 14 in the table in this document
Identification of future technical improvements	Included	Several areas for future technical improvement have been identified (see finding ID#s 1–2, 6, 9–10 and 15–17 in the table in and para. 24 of this document)

Annex II

Reference documents

A. Reports of the Intergovernmental Panel on Climate Change

IPCC. 2003. *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. J Penman, M Gytarsky, T Hiraishi, et al. (eds.). Hayama, Japan: Institute for Global Environmental Strategies. Available at http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.html.

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.

IPCC. 2019. *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.* E Calvo Buendia, K Tanabe, A Kranjc, et al. (eds.). Geneva: IPCC. Available at https://www.ipcc-nggip.iges.or.jp/public/2019rf/index.html.

B. UNFCCC documents

First biennial update report of the Sudan. Available at https://unfccc.int/BURs.

First modified FRL submission of the Sudan. Available at https://redd.unfccc.int/submissions.html?country=sdn.

"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.

NC1, NC2 and NC3 of the Sudan. Available at https://unfccc.int/non-annex-I-NCs.

Report on the TA of the proposed FRL of the Sudan submitted in 2020. FCCC/TAR/2020/SDN. Available at https://unfccc.int/documents/273858.

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:

FAO. 2016. Map Accuracy Assessment and Area Estimation: A Practical Guide. National forest monitoring assessment working paper No.46/E, 60p.

FAO. 2021. *National Forest Inventory Final Report*: https://openknowledge.fao.org/server/api/core/bitstreams/9d8fe4c5-b3c5-45c0-9cac-07c5b64d4c0c/content.