TECHNICAL ANNEX II: RESULTS ACHIEVED BY BRAZIL FROM REDUCING GREENHOUSE GAS EMISSIONS FROM DEFORESTATION IN THE CERRADO BIOME FOR REDD+ RESULTS-BASED PAYMENTS

1. INTRODUCTION

Brazil welcomes the opportunity to submit a Technical Annex to its Fourth Biennial Update Report (BUR) in the context of results-based payments for reducing emissions from deforestation and forest degradation, conservation of forest carbon stocks, sustainable management of forests, and enhancement of forest carbon stocks in developing countries (REDD+), under the United Nations Framework Convention on Climate Change (UNFCCC).

Brazil notes that the submission of this Technical Annex with REDD+ results is voluntary and exclusively for the purpose of obtaining and receiving results-based payments for its REDD+ actions, pursuant to decisions 13/CP.19, 13/CP.19, paragraph 2, and 14/CP.19, paragraphs 7 and 8.

This submission, therefore, does not modify, revise or adjust in any way the Nationally Appropriate Mitigation Actions (NAMA) voluntarily submitted by Brazil under the Bali Action Plan (FCCC/AWGLCA/2011/INF.1), neither the Brazilian Nationally Determined Contribution (NDC) under the Paris Agreement under the UNFCCC.

The Cerrado is Brazil's second largest biome in terms of territory. Together with the Amazon biome, they comprise approximately 73% of the national territory. This submission was developed by the Brazilian Government and presents the results achieved by Brazil from reducing greenhouse gas emissions from deforestation from 2018 to 2020 in the Cerrado biome. This initiative is another step for Brazil towards the measurement, reporting and verification of REDD+ results for the entire national territory. It benefits from improvements established after previous submissions evaluation processes regarding the Amazon biome and from FREL evaluation that endorse the results presented in this Annex.

2. SUMMARY INFORMATION FROM THE ASSESSED FOREST REFERENCE EMISSION LEVEL FOR REDUCING EMISSIONS FROM DEFORESTATION IN THE CERRADO BIOME

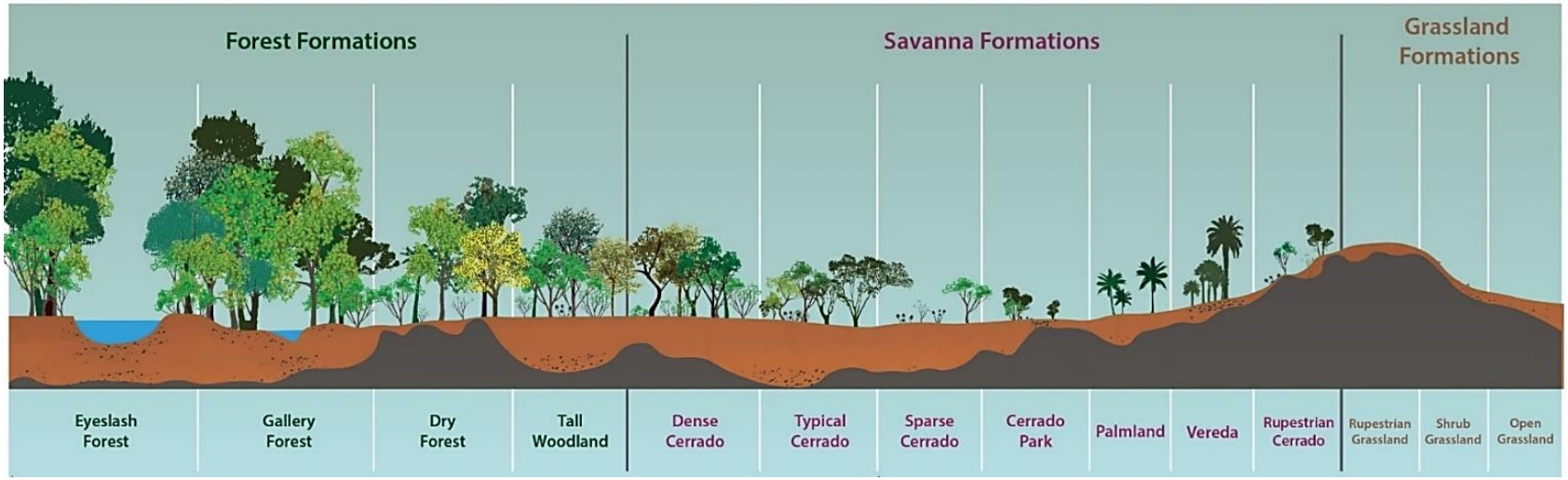
Brazil applied a step-wise approach to develop a national FREL, in accordance with decision 12/CP.17, paragraph 10. The step-wise approach enables Parties to continuously improve their data and submissions, by incorporating better data, improved methodologies and, where appropriate, additional carbon pools.

The Forest Reference Emission Level for the Cerrado biome, which comprises approximately 2,036,448 km², henceforth referred to as FREL Cerrado, was submitted on a voluntary basis by Brazil for a technical assessment in the context of results-based payments for REDD+ and covered the activity "reducing greenhouse gas emissions from deforestation", considered the most significant for Brazil among the five REDD+ activities included in paragraph 70 of decision 1/CP.16.

Brazil submitted its FREL Cerrado on 6 January 2017 in accordance with decisions 12/CP.17 and 13/CP.19. The technical assessment took place (as a centralized activity) from 13 to 17 March 2018 in Bonn. As a result of the facilitative interactions with the assessment team (AT), Brazil provided a modified version of its submission on 23 May 2017, which took into consideration the technical inputs of the AT. Finally, the technical assessment report was published on 31 August 2017.

The construction of the FREL Cerrado followed the guidelines set out in the IPCC Good Practice Guidance for Land Use, Land-use Change and Forestry[1] (IPCC, 2003) to estimate the changes in carbon stocks in areas of natural forest converted to other land-use categories.

The classification of the vegetation used in the FREL Cerrado is that of Ribeiro and Walter (2008), which define forests as environments with predominance of tree species and continuous or discontinuous canopy formation, while the savanna formations are constituted by the coexistence of the tree, shrub and herbaceous extracts. The outland formations are characterized by the predominance of herbaceous and shrub species, with few trees, where no canopy formation is observed. Figure 1 is a representation of different vegetation phytophysiognomies of the Cerrado. In addition to the forest formations identified in the figure, other phytophysiognomies that fit the structural characteristics of the forest definition adopted by Brazil in other international communications were included – Cerrado Denso (Thick Cerrado) and Cerrado Típico (Typical Cerrado).



Source: *Adapted from Ribeiro and Walter, 2008.*

FIGURE 1: PICTORIAL REPRESENTATION OF THE MAIN VEGETATION PHYTOPHYSIOGNOMIES IN THE CERRADO BIOME, IN A BIOMASS GRADIENT (FROM THE LARGEST FOREST FORMATIONS, ON THE LEFT, TO THE SMALLEST ONES - SAVANNAS AND GRASSLANDS, ON THE RIGHT).

[1] *Henceforth referred to as IPCC Good Practice Guidance for LULUCF.*

Emissions from deforestation in the period 2000-2010, which are part of FREL Cerrado, were estimated by combining activity data (annual deforested area in different forest types) and appropriate emission factors (carbon stocks in biomass associated with the relevant forest type).

Activity data for the elaboration of FREL Cerrado were included in the series of the National Institute for Space Research (INPE), under the Ministry of Science, Technology, Innovations and Communications (MCTIC). INPE, as a supplier of Brazilian Biomes Environmental Monitoring Program (PMABB), has been generating gross deforestation annual estimates for Cerrado biome using Landsat class satellite data for a complete survey of the region, with a minimum mapping of 1 hectare and employing an interpretation scale of 1: 75,000. From a reference map, natural areas (including savannas, rupestrian and forest formations) were mapped and converted to other uses in the years 2000-2002; 2002-2004; 2004-2006; 2006-2008 and 2008-2010.

The next stage involved a territorial cut of the relevant forest typologies. 23 phytophysiognomies were defined, including, the two most abundant being the Wooded Savannah (Sa) and the Submontane Semi Deciduous Seasonal Forest (Fs), which cover approximately 29% and 12% of the biome, respectively. Forest formations considered for FREL Cerrado account for about 65% of the biome; the remaining 35% are distributed in rupestrian and savannah formations, which are not included in the FREL Cerrado.

Emission factors for FREL Cerrado were defined in the form of carbon in living biomass (above and belowground biomass) and dead organic matter (litter and dead wood), and are consistent with those adopted in the III Inventory. Regarding gases included, FREL Cerrado considered emissions of CO_2 and non-CO_2 gases. The premise adopted was that the biomass immediately after the conversion of forest to other categories of land use is zero, and did not consider any CO2 removal after conversion (considering only the gross emissions from deforestation).

Gross annual emissions from deforestation were estimated from the increased annual deforestation observed[2], as discussed in detail in section 4.1 and in the FREL Cerrado. The areas of deforested polygons in a given forest typology were multiplied by the corresponding emission factor, generating the total carbon quantity[3] (in tons of carbon per hectare (tC ha^{-1}). Subsequently, the amount of total carbon was multiplied by an equivalence factor of 44/12 to convert tonne of carbon into tonne of CO_2 (tCO_2 ha^{-1}). Calculations are also performed to estimate the emissions of non-CO_2, CH_4 and N_2O gases, with equivalence factors for each of these gases, in order to express them in CO_2eq. Then, for each year considered, estimates of CO_2eq emissions associated to each polygon were summed (see spreadsheets with emission estimates available at http://redd.mma.gov.br/en/infohub).

FREL Cerrado does not include future projections. It is based on historical deforestation data.

For emissions reductions results from 2011 to 2020, the FREL is the average annual CO_2eq emissions associated to gross deforestation in the period 2000 to 2010, inclusive (see

[2] Increased deforestation refers to the sum of the area of all deforestation polygons observed within a given geographic extent. In the submission of the FREL and also in this Technical Annex, increased deforestation refers to the sum of deforested areas observed in each satellite scene that covers the biome. The increase in deforestation may underestimate the total deforested area (and corresponding emissions), since it does not include the area of deforestation under clouds.

[3] Total carbon refers to the sum of carbon in above-ground biomass, below-ground biomass, litter and dead wood.

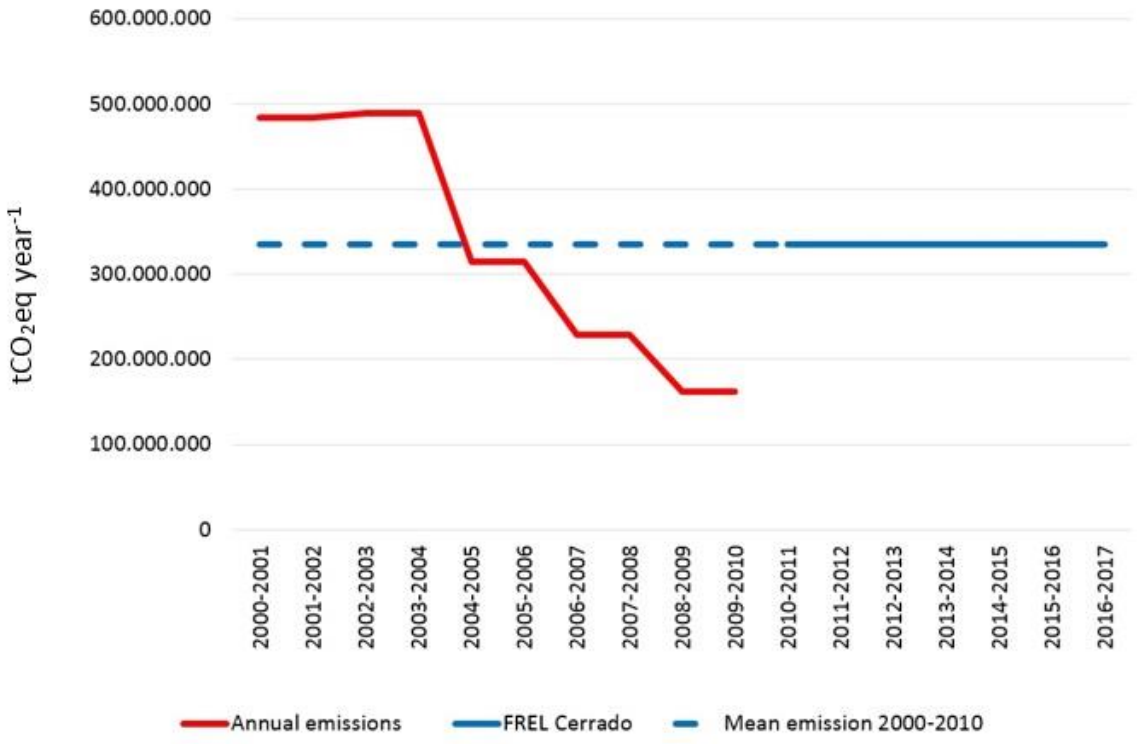


FIGURE 2 and

TABLE 1).

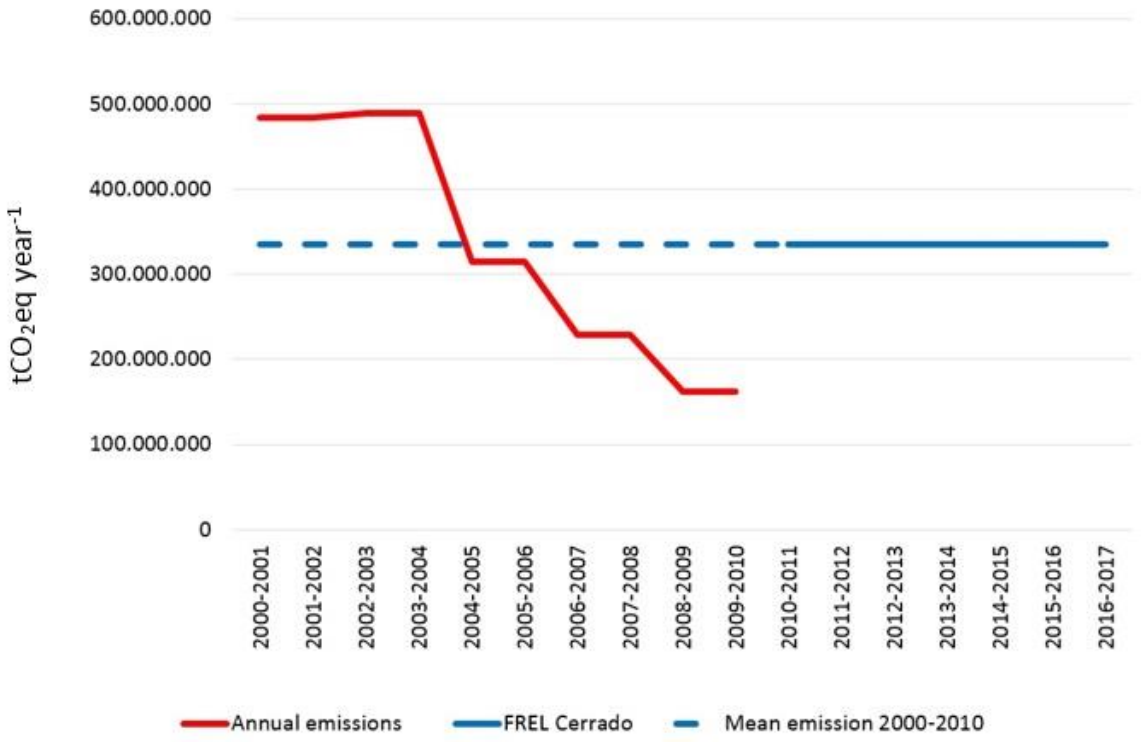


FIGURE 2: PICTORIAL REPRESENTATION OF BRAZIL'S FREL FOR THE CERRADO BIOME. THE CONTINUOUS LINE REFERS TO THE MEAN OF THE AVERAGE ANNUAL CO_2eq EMISSIONS FROM DEFORESTATION FROM 2000 TO 2010 (335,540,289 $tCO_2eq\ year^{-1}$).

TABLE 1: ANNUAL INCREMENTS OF DEFORESTATION AND ASSOCIATED EMISSIONS IN THE CERRADO BIOME, FROM 2000 TO 2010.

Period	Average annual increments of deforestation (ha/yr)	Average annual CO_2 emissions from deforestation (tCO_2/yr)	Average annual CH_4 emissions from deforestation (tCO_2eq/yr)	Average annual N_2O emissions from deforestation (tCO_2eq/yr)	Total average annual emissions from deforestation (tCO_2eq/yr)
2000-2001	2,087,304	465,970,129	12,178,766	5,287,700	483,436,595
2001-2002	2,087,304	465,970,129	12,178,766	5,287,700	483,436,595
2002-2003	2,124,167	471,978,963	12,248,373	5,317,921	489,545,257
2003-2004	2,124,167	471,978,963	12,248,373	5,317,921	489,545,257
2004-2005	1,343,484	302,901,230	8,008,462	3,477,063	314,386,755
2005-2006	1,343,484	302,901,230	8,008,462	3,477,063	314,386,755
2006-2007	990,019	220,010,901	5,858,795	2,543,735	228,413,431
2007-2008	990,019	220,010,901	5,858,795	2,543,735	228,413,431
2008-2009	751,923	156,192,837	3,992,941	1,733,630	161,919,408
2009-2010	751,923	156,192,837	3,992,941	1,733,630	161,919,408

3. RESULTS IN TONNES OF CO_2eq PER YEAR, CONSISTENT WITH THE ASSESSED FOREST REFERENCE EMISSION LEVEL FOR THE CERRADO BIOME

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

The CO_2eq emissions from gross deforestation in the Cerrado biome in the period from 2000 to 2010, used in the construction of the Cerrado FREL, were estimated using the methodology presented in the previous section. For this Technical Annex, the results for the period from 2018 to 2020 were calculated by subtracting the mean annual CO_2eq emissions from forest reference emission level for the period from 2000-2010, totaling 335,540,289 tCO_2eq.

Hence, for year t in the period from 2018 to 2020, the emission reduction from deforestation was estimated as follows:

REDD+ (t) = FREL (2000-2010) – Total mean emissions at year t; (tCO_2eq)

For example, the emission reduction from deforestation in 2019 is equal to:

335,540,289 tCO_2eq – 98,401,731 tCO_2eq = 237,138,558 tCO_2eq

The total emission reduction from gross deforestation in the Cerrado biome, from 2018 to 2020, was equal to the sum of the emission reduction results achieved for each year in the period: **697,486,485 tCO_2eq** (**FIGURE 3** and **TABLE 2**).

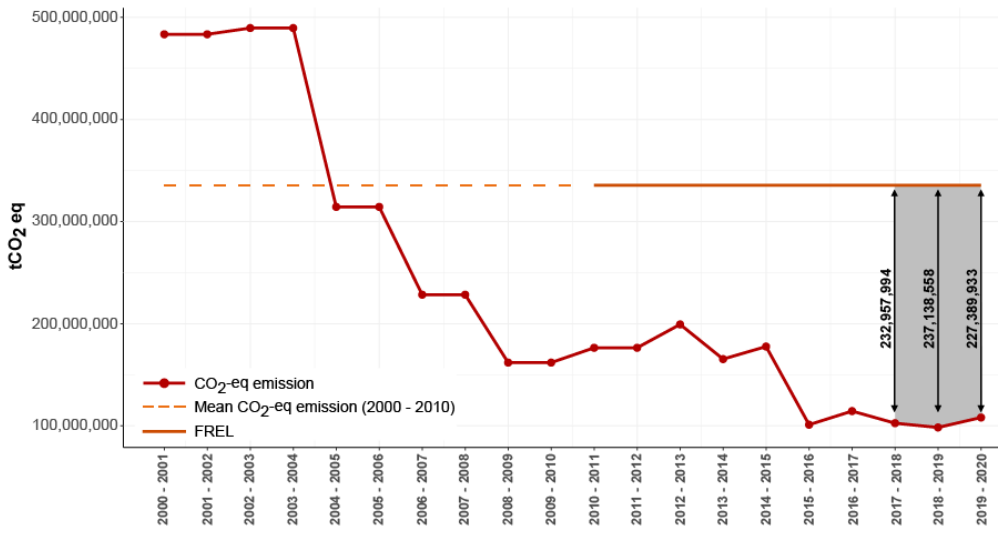


FIGURE 3. PICTORIAL REPRESENTATION OF BRAZIL'S REDD+ RESULTS ACHIEVED IN THE CERRADO BIOME, BASED ON THE MODIFIED VERSION OF FREL CERRADO.

TABLE 2: AVERAGE ANNUAL EMISSIONS (TCO_2eq/yr) FROM 2000 TO 2020; FOREST REFERENCE EMISSION LEVEL USED TO ESTIMATE THE EMISSION REDUCTION RESULTS IN THE PERIOD 2011-2020 (TCO_2eq/yr); AND REDD+ RESULTS ACHIEVED (TCO_2eq/yr).

Period	Average annual increments of deforestation (ha/yr)	Average annual CO_2 emissions from deforestation (tCO_2/yr)	Average annual CH_4 emissions from deforestation (tCO_2eq/yr)	Average annual N_2O emissions from deforestation (tCO_2eq/yr)	Total average annual emissions from deforestation (tCO_2eq/yr)	FREL Cerrado (tCO_2eq/yr)	Annual REDD+ results 2011 - 2017 (tCO_2eq/yr)
2000-2001	2,087,304	465,970,129	12,178,766	5,287,700	483,436,595		
2001-2002	2,087,304	465,970,129	12,178,766	5,287,700	483,436,595		
2002-2003	2,124,167	471,978,963	12,248,373	5,317,921	489,545,257		
2003-2004	2,124,167	471,978,963	12,248,373	5,317,921	489,545,257		
2004-2005	1,343,484	302,901,230	8,008,462	3,477,063	314,386,755		
2005-2006	1,343,484	302,901,230	8,008,462	3,477,063	314,386,755		
2006-2007	990,019	220,010,901	5,858,795	2,543,735	228,413,431		
2007-2008	990,019	220,010,901	5,858,795	2,543,735	228,413,431		
2008-2009	751,923	156,192,837	3,992,941	1,733,630	161,919,408		
2009-2010	751,923	156,192,837	3,992,941	1,733,630	161,919,408		
2010-2011	780,329	170,077,706	4,436,942	1,926,403	176,441,051		
2011-2012	780,329	170,077,706	4,436,942	1,926,403	176,441,051		
2012-2013	1,012,529	192,663,414	4,652,797	2,020,122	199,336,333		
2013-2014	763,679	159,504,096	4,082,509	1,772,518	165,359,123		
2014-2015	884,988	171,624,991	4,204,420	1,825,449	177,654,860		
2015-2016	514,511	97,706,934	2,373,838	1,030,658	101,111,430		
2016-2017	571,616	111,225,004	2,243,219	973,947	114,442,170		
2017-2018	**510,953**	**99,055,099**	**2,459,393**	**1,067,804**	**102,582,295**	**335,540,289**	**232,957,994**
2018-2019	**496,707**	**95,064,541**	**2,326,908**	**1,010,282**	**98,401,731**	**335,540,289**	**237,138,558**
2019-2020	**563,056**	**104,504,333**	**2,542,246**	**1,103,776**	**108,150,356**	**335,540,289**	**227,389,933**
Total of REDD+ achieved in the period 2018-2020 (tCO_2eq/yr)							**697,486,485**

4. DEMONSTRATION THAT THE METHODOLOGIES USED TO PRODUCE THE RESULTS ARE CONSISTENT WITH THOSE USED TO ESTABLISH THE FOREST REFERENCE EMISSION LEVEL

The methodology, data sets and information used for calculating the results presented herein are the same as the ones used in the construction of the **FREL Cerrado**, as demonstrated below:

4.1 ACTIVITY DATA

The area of each deforestation polygon in a certain forest physiognomy is the data needed to estimate emissions from deforestation[4], following the IPCC good practice guidance for LULUCF (IPCC, 2003).

Similar to calculation for FREL Cerrado, activity data used here to generate the results are derived from the PMABB, adapted to include only land use change in areas that used to be forests. The minimum mapping area of 1 hectare was maintained, obtained with resolution 1:75,000 during visual interpretation.

The vegetation map used to identify forest phytophysiognomies affected by deforestation and the references used to generate carbon estimates were the same as those used in the III National Inventory of Greenhouse Gases, submitted to the UNFCCC in May 2016, thus ensuring total consistency between FREL Cerrado and the national inventory of greenhouse gases.

4.2 EMISSION FACTORS

The emissions factors used for forest phytophysiognomies considered for the calculation of REDD+ results achieved in the Cerrado biome are the same used in the modified FREL Cerrado version and carbon map of the Third National Communication of Brazil to the UNFCCC.

4.3 CARBONS POOLS

FREL Cerrado includes the following carbon pools: above and below-ground biomass, litter and dead wood. The Carbon Map of the Third National GHG Inventory mentioned in section 4.2 includes carbon in biomass of these four pools. Results presented in this Technical Annex maintain the same pools.

4.4 NON-CO_2 GASES

Consistent with the FREL Cerrado, this submission considered non-CO_2, C_H4 and N_2O gases. The decision to include these gases in the FREL Cerrado was made after an international assessment process, in which experts pointed out by the UNFCCC Secretariat recommended it and Brazilian experts accepted their suggestions.

[4] *In most first order approaches, "activity data" are expressed in terms of land use area or land use change. The general guideline is to multiply the activity data by a carbon stock coefficient or "emission factor" to get to the estimates of sources/or sinks." (IPCC, 2003; section 3.1.4, page 3.15).*

4.5 REDD+ ACTIVITIES

Like FREL Cerrado, emissions estimates were calculated focusing on emissions from gross deforestation, and, therefore do not include emissions from other REDD+ activities.

Brazil has been conducting internal discussions since 2015 within the framework of the REDD+ Workgroup on the treatment of forest degradation and how their respective emissions can be included in future submissions. Although there are monitoring initiatives that advance the production of information on forest degradation in the Amazon biome, the REDD+ Workgroup considers that the monitoring of this activity for the Cerrado biome is even more complex.

5. DESCRIPTION OF THE NATIONAL FOREST MONITORING SYSTEM AND INSTITUTIONAL ROLES AND RESPONSIBILITIES FOR MEASURING, REPORTING AND VERIFYING THE RESULTS

5.1 ARRANGEMENT OF BRAZIL'S NATIONAL FOREST MONITORING SYSTEM

Due to Brazil's extensive coverage of native vegetation and the dynamics of land use and occupation, the Brazilian Government has been implementing a series of systems to monitor these phenomena over the years. These systems, each with its own characteristics and purposes, make up a robust arrangement for monitoring and implement actions in the LULUCF sector. Figure 4 below presents the main systems that make up this arrangement.

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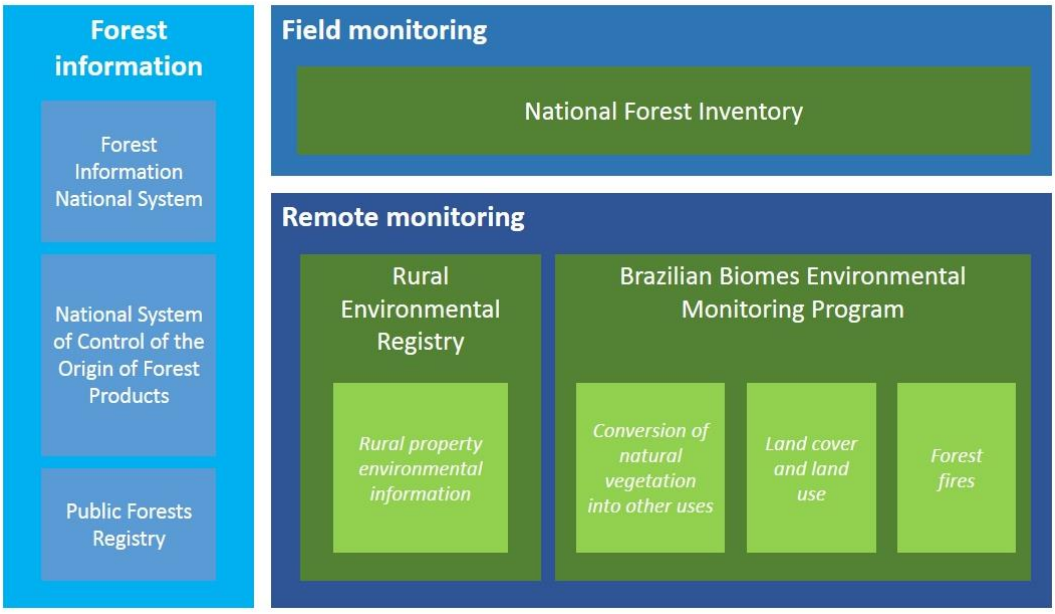

FIGURE 4: IMPLEMENTATION ARRANGEMENT OF THE NATIONAL FOREST MONITORING SYSTEM

As per Section 6 of the BUR, the systems presented above provide contributions to the implementation and monitoring of LULUCF's NAMAs, as well as the MRV process of REDD+ results, in addition to those intended to provide and organize forest information[5]. **Further to what has been**

[5]*For further information:*
National Forest Information System: http://snif.florestal.gov.br/pt-br/
National System for the Control of the Origin of Forest Products: http://www.ibama.gov.br/
Public Forest Register: http://www.florestal.gov.br/cadastro-nacional-de-florestas-publicas

described in section 6 of the BUR, additional information is presented below about the initiatives that provide inputs directly related to the MRV of REDD+.

5.1.1 BRAZILIAN BIOMES ENVIRONMENTAL MONITORING PROGRAM (PMABB)

The Program (also known by its acronym PMABB) seeks to promote joint actions, in coordination with various Federal Government agencies working with the satellite monitoring of land cover and use initiatives (such as Embrapa/MAPA, IBGE, IBAMA/MMA, INPE/MCTIC and research institutions), to harmonize as much as possible the various mappings of the Brazilian biomes, in various cartographical and time scales, according to the characteristics of each theme, to produce and make available harmonized, systematic and updated official information.

For the Amazon and Cerrado, the PMABB provides for the monitoring of past deforestation, to develop the definitions of reference levels of these biomes' greenhouse gas emissions. For the Amazon, the monitoring of land use in 1991, 2000, 2004 and 2008 was carried out recently and, for the Cerrado, mapping of historical deforestation series was completed every two years from 2000 to 2010, as well as annual data between 2012 and 2020 – which were the basis for FREL Cerrado, for the latest Technical Annex on REDD+ for Cerrado biome and for this Technical. The availability of deforestation data will also contribute to the control and management of authorizations to suppress natural vegetation, especially at the state level.

Monitoring of natural vegetation conversion, land cover and land use will be extended throughout Brazil, by the gradual and programmed extension of the program's activity area. For extra-Amazonian Brazilian biomes, there is a need to expand monitoring initiatives, especially those related to deforestation and land cover and use. Such information will also support decision-making in actions to promote the conservation of Brazilian biodiversity and contribute to a strategic territorial management that combines the various interests on land use and allows country's sustainable development.

Cerrado was the first biome outside the Amazon to be contemplated by PMABB actions. Its methodology considers the mapping of all land use conversions, assuming deforestation as the complete removal of native vegetation cover, regardless of subsequent use of these areas. Deforested areas larger than one hectare are mapped and quantified using 118 Landsat-class satellite images each year of the analyzed period, ensuring product compatibility with the 1:250,000 cartographic scale. Deforestation identification process is made by visual interpretation of images directly on the computer screen, using the TerraAmazon geographic information system, developed by INPE that are available at Terrabrasilis[6] website. **It is important to mention that the data used for REDD+ purposes, is a subset of what is presented in the Terrabrasilis website**.

The entire database produced by INPE under Prodes Cerrado is undergoing an unprecedented process of external evaluation, an activity conducted by the Laboratory of Image Processing and Geoprocessing (LAPIG for its Portuguese acronym) of the Federal University of Goiás. The validation strategy of Prodes Cerrado is based on a set of random points drawn over the anthropic areas detected between 2000 and 2020, and also areas of natural vegetation remaining within Cerrado in 2020. A system called Temporal Visual Inspection (TVI) was developed to increase efficiency of this step. It integrates Landsat, Modis and Sentinel satellites as well as the high-resolution imagery available on Google Maps into a dedicated web page, allowing to organize multiple data in one environment, making it easy to identify any changes in land cover, year per year in the period analyzed. At the end of this process, it will be possible to determine the accuracy of deforestation maps produced, and establish a confidence interval for the estimation of the anthropic area in the Cerrado biome.

[6] http://terrabrasilis.dpi.inpe.br/

5.2 ROLES AND RESPONSIBILITIES FOR MEASURING, REPORTING AND VERIFYING (MRV) REDD+ RESULTS

FIGURE 5: MRV FOR REDD+ IN BRAZIL.

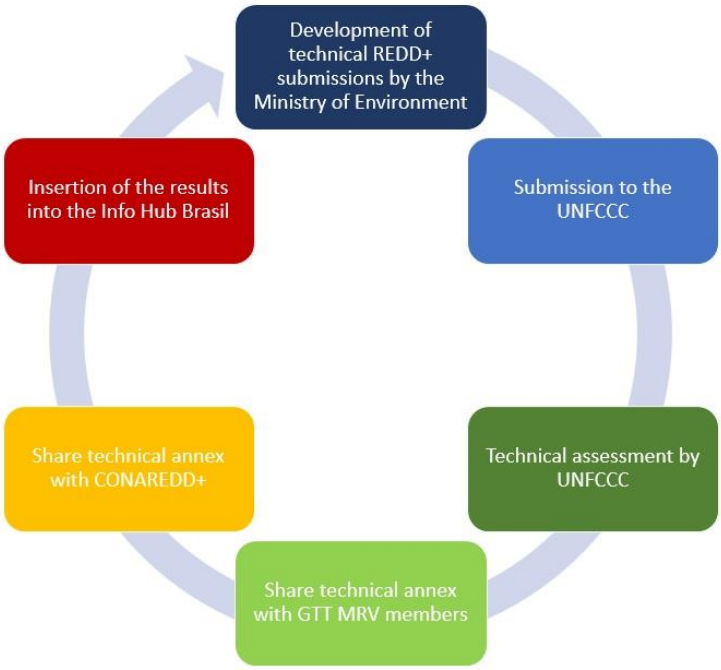

FIGURE 5: BELOW PRESENTS THE MRV PROCESS OF REDD+ RESULTS IN BRAZIL.

Table 3 presents the institutions in charge of MRV for REDD+ in Brazil.

TABLE 3: ROLE AND INSTITUTIONAL RESPONSIBILITIES FOR REDD+ MRV IN BRAZIL.

MRV	INSTRUMENT	RESPONSIBLE INSTITUTION	ROLE	ADDITIONAL INFORMATION
MEASURING	Technical Work Group on Measurement, Report and Verification (GTT MRV)	Institution contracted to do the mapping and generating results estimates	To map the deforestation polygons in the Cerrado biome, consistent with the methodologies used in the assessed FREL Cerrado; estimate the annual emissions, ensure consistency with the Third National GHG Inventory	http://www.inpe.br
		INPE/MCTIC	To carry out the quality assurance and quality control of products generated by the contracted institution.	http://www.obt.inpe.br/prodes/index.php
	Executive Secretariat of the National REDD+ Committee (CONAREDD+)	MMA	To carry out quality control of emission estimates produced by the contracted institution. To develop the submissions to UNFCCC under the guidance of the GTT MRV. To verify consistency with the FREL.	http://redd.mma.gov.br/en/the-national-redd-committee

REPORTING	Presidency of CONAREDD+ Focal point to the UNFCCC	MMA MRE	To Forward the REDD+ submission to UNFCCC.	http://redd.mma.gov.br/en/the-national-redd-committee
	Info Hub Brasil	MMA	To compile and make available documentation needed for the recognition of the REDD+ results until its verification by the ICA and insertion in the Lima REDD+ Information Hub.	http://redd.mma.gov.br/en/infohub
VERIFYING	International Consultation and Analysis	UNFCCC	To verify the submission by Parties, indicating experts in Land use and Forestry (LULUCF) to evaluate the FREL submissions and technical annexes.	http://unfccc.int/methods/redd/redd_web_platform/items/4531.php
		MMA	To provide the clarification information requested by the experts in charge of the technical evaluation and verification of results consistency. To exchange with the experts indicated by UNFCCC for technical evaluation of the submission of the FREL and results.	

6. NECESSARY INFORMATION THAT ALLOWS FOR THE RECONSTRUCTION OF THE RESULTS

For REDD+ purposes, complete information means the provision of data that allows for reconstruction of FREL and the REDD+ results.

Links to the database and information that allows for results reconstruction are listed in Section b.1 of FREL Cerrado. Data are listed below and can be accessed at Info Hub Brasil (http://redd.mma.gov.br/en/infohub).

1. **Satellite imagery from years 2000, 2002, 2004, 2006, 2008 and 2010** used to identify deforestation polygons in the Cerrado biome during 2000-2010.
2. **Reference map** containing accumulated deforestation in forest phytophysiognomies by 2000, inclusive.
3. **Maps containing deforestation polygons identified in each period** (2000-2002, 2002-2004, 2004-2006, 2006-2008, 2008-2010) from an analysis of images indicated in (1).

IMPORTANT NOTE 1: Maps listed under (2) and (3) are available in shapefile format, ready to be incorporated in a geographical database for analysis. Any individual deforestation polygon can be verified in relation to the corresponding satellite image.

4. **Database listing all deforested polygons in each period**, their area, forest phytophysiognomy, emission factors used for live biomass, dead organic matter (reservoirs) and emissions associated with the polygon;
5. **Carbon stock values per unit area** of different phytophysiognomies in Cerrado biome, consistent with that used in III Inventory;
6. **Bibliography used to estimate carbon** in above and below-ground biomass; litter; and dead wood.

7. DESCRIPTION OF HOW THE ELEMENTS CONTAINED IN DECISION 4/ CP.15, PARAGRAPH 1(C) AND (D), HAVE BEEN TAKEN INTO ACCOUNT

7.1 USE OF THE MOST RECENT IPCC GUIDANCE AND GUIDELINES

FREL Cerrado and this Technical Annex use methodologies described in the IPCC Good Practice Guidance for LULUCF (IPCC, 2003) as a basis for estimating changes in carbon stock in forested areas converted to other land uses. For any conversion occurring at a given year, the IPCC considers the carbon stock in the biomass immediately before and immediately after conversion. Brazil only considers losses of carbon stock in biomass, immediately before conversion (gross emissions). Brazil applies the basic method for estimating emissions suggested by IPCC, i.e., emissions estimated as the product of activity data and emission factor.

7.2 ESTABLISH, ACCORDING TO NATIONAL CIRCUMSTANCES AND CAPABILITIES, ROBUST AND TRANSPARENT NATIONAL FOREST MONITORING SYSTEMS

Activity data used in the construction of FREL Amazonia and FREL Cerrado for the calculation of results presented on the Technical Annexes originated from initiatives in the scope of the Brazilian Biomes Environmental Monitoring Program. As described in Section 5.1, in a near future, the harmonization of land use/cover monitoring initiatives will allow the regular production of emission data from deforestation in the Caatinga, Atlantic Forest, Pantanal and Pampas biomes. Field data will also be available through the National Forest Inventory that will certainly enhance the quality of forest carbon estimates. Both initiatives are of great importance to the advancement of the forest

agenda in Brazil and are instrumental for the establishment of robust and transparent forest monitoring systems at the national level.