COMMUNITY BASED AVOIDED DEFORESTATION PROJECT IN GUINEA-BISSAU

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1 PROJECT DETAILS

1.1 Summary Description of the Project

The objective of the project is to avoid deforestation of the forest areas situated within two National Parks in the Republic of Guinea Bissau (GB), thus reducing carbon emissions and contributing to the protection of these globally important biodiversity sites. Cacheu Mangrove Forest National Park is located in the administrative region of Cacheu, São Domingos and Cacheu sectors, encompasses 28.052 inhabitants in 23 villages/tabancas (INEC, 2007) and comprises a total area of 74,700 hectares. It was created with the objective of protecting the most relevant patches of mangrove in the northern part of GB, which are located around the Cacheu River estuary. The other predominant vegetation cover types in this region are open forest and palm groves. Cantanhez Forest National Park, with an area of 106,500 hectares, is located in the administrative region of Tombali, covering the Bedanda sector and encompasses 22.505 inhabitants in 111 villages/tabancas (INEC, 2007). Cantanhez forests represent the last remaining patches of primary sub-humid forest, which form part of a larger area that extends to the south, into neighboring Guinea Conakry. Terrestrial vegetation in the Cantanhez Park consists of patches of dense mature forest in a mosaic of patches of secondary forests, as the result of the cultivation and fallow stages of shifting agricultural practices. Mangroves cover a large proportion of the area of the park, particularly to the south and western regions, on the margins of the Cumbijã River.

Underlying causes of deforestation in the project area include mainly unsustainable land use practices related to agricultural extensification by the local community. From 2005-2011, the World Bank, Global Environment Facility (GEF), and European Commission (EC) provided support to the Government of Guinea Bissau to protect large areas of coastal mangrove and forests through the Coastal and Biodiversity Management Project (CBMP). The CBMP efforts led to the creation of the Institute for Biodiversity and Protected Areas of Guinea-Bissau (IBAP) and the establishment of a financial instrument called the Fund for Local Environmental Initiatives (FIAL). The CBMP also assisted in the establishment of a protected area network, including Cacheu and Cantanhez National Parks, which are managed by IBAP.

However, the CBMP, which provided the bulk of the funding for both the investment and operating costs for these parks, closed on March 2011. Two follow-on projects financed by the GEF and the World Bank over two and four years, respectively, are providing US$2.95 million in short term, stopgap financing for the basic operating costs of the protected area network while more sustainable financing is identified. Given the country's extreme poverty, the Government will not be able to finance the ongoing management of these parks from the national budget. There is a real risk, therefore, that IBAP will not have the necessary financing to continue to protect these areas.

The proposed REDD project, seeks to enable Guinea Bissau to support the work of IBAP and to provide additional tangible financial benefits to the participating communities. Without the carbon financing, the parks will not be able to guarantee the protection of the forests they contain and the rate of deforestation will accelerate. The project is expected to reduce an annual average of 920,426 tCO_2e totaling 18,408,530 tCO_2e in the first crediting period (20 years).

1.2 Sectoral Scope and Project Type

Scope 14. AFOLU: Reduced Emissions from Deforestation and Degradation (REDD)

Project Category: Activities that reduce emissions from unplanned deforestation (AUDD)

1.3 Project Proponent

Organization name	Instituto da Biodiversidade e das Áreas Protegidas da República da Guiné-Bissau – IBAP
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1.4 Other Entities Involved in the Project

Organization name	The World Bank
Role in the project	Project preparation support
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Organization name	BioGuinea Foundation
Role in the project	Project implementation partner
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1.5 Project Start Date

31/March/2011

This date corresponds to the closure of the CBMP.

1.6 Project Crediting Period

The Project Crediting Period is 20 years and can be renewed at most four times.

Start Date: 31/March/2011 – End Date: 30/March/2031

Baseline must be revised every 10 years. Next baseline revision to be carried on 31st of December 2021.

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

Project	x
Large project	

Years	Estimated GHG emission reductions or removals (tCO_2e)
2013	75,251
2014	153,844
2015	235,776
2016	321,050
2017	409,664
2018	501,619
2019	596,914
2020	695,550
2012	797,527
2022	902,845
2023	978,096
2024	1,056,688
2025	1,138,621
2026	1,223,895
2027	1,312,509
2028	1,404,464
2029	1,499,759

2030	1,598,395
2031	1,700,372
2032	1,805,690
Total estimated ERs	18,408,530
Total number of crediting years	20
Average annual ERs	920,426

1.8 Description of the Project Activity

The REDD project activity will support the long term conservation of the mangrove and terrestrial forests of two National Parks of high biodiversity relevance that would otherwise be unable to be financed. The project is not located within a jurisdiction covered by a jurisdicational REDD+ program. The REDD Project, through the sale of carbon credits, will provide sustainable and stable flow of funds to IBAP and, through FIAL, to the participating communities for the continued operation of Cacheu and Cantanhez National Parks.

IBAP is the project proponent and the institution in charge of operating and managing this REDD initiative. Amongst other responsibilities, IBAP will run all on-the-ground activities, provide technical support for communities, operate the micro-finance mechanism (FIAL), organize the park committee meetings and monitor the REDD project.

The protected area sustainability strategy rests on securing sustainable financing streams for the long term. The country is in the process of establishing the BioGuinea Foundation, a private, non-profit institution with public utility to help secure this objective. It is envisioned that this Foundation will, over time, gradually build up an endowment fund sufficient to provide sustainable financing for managing the country's parks and biodiversity in perpetuity. According to the World Bank, operating a modestly staffed and equipped system for IBAP and the existing 5 National Parks in Guinea-Bissau would cost an estimated USD 1.0 million p.a, implying an optimal endowment fund for the Foundation of some USD 20.0 million[1]. This REDD activity is a key element of that strategy. Therefore, the BioGuinea Foundation role is to guarantee transparency in the financial management of the project and reduce dependency on donor money. All revenues from carbon sales will be received by the Foundation and will be sent to IBAP in accordance with the project budget plan and work schedule. It is also expected that the Foundation will provide a better access to market, facilitating the transaction of VERs with buyers in Europe.

On the ground, the project will halt deforestation through the application of a community based management approach in conjunction with an innovative micro-finance mechanism, the FIAL. In addition to traditional park management efforts, like surveillance, enforcement and fire control, IBAP operates a participatory management model, strongly linked with the local communities. Participatory surveillance involves the community in the task of preventing deforestation activities, reducing the demand for park guards and expanding monitoring coverage in the Project Area. The community is also directly involved in the management of the area. The Park Management Committee meets bi-annually with 50 percent community participation, establishing a collaborative ethic supporting sustainable development in the

[1] Considering a 5% investment return

Project Area. The active participation of the community is paramount to project success. So far, community support and engagement have been high, as they understand the relevance of the parks and the forest it contain.

Organized communities residing in and around (2 km buffer) the Project Areas will have access, via FIAL, to small scale, socio-economic investments with conservation goals. The project activity will support community development activities in and around Cantanhez Park and Cacheu Park through this micro-finance mechanism which facilitates adoption of simple, innovative technologies designed to increase incomes and improve social infrastructure while curbing deforestation, improving drainage, conserving water and protecting water sources, preserving mangrove zones and building local ownership of the principles and practices supporting sustainable fisheries and coastal management.

The project was developed with financial and technical assistance from the World Bank. All fieldwork to the establishment of the baseline, the PD development and the validation of this REDD project activity was supported by the World Bank and its partners. The REDD project activity will strengthen the community-based management of these areas clearly demonstrating tangible financial benefits from forest protection through carbon finance.

More specifically, the project will provide:

- Sustainable and stable flows of funds to Cantanhez and Cacheu Parks;
- Continued and additional support to IBAP to operationalize the management of Cacheu and Cantanhez Parks to protect the forests they contain; and
- Additional financing through the FIAL mechanism to ensure that the communities in and around the parks realize direct and tangible benefits from forest protection.

1.9 Project Location

The project comprises two distinct areas in the Republic of Guinea-Bissau totaling 181,200 hectares of which 145,698 hectares are considered the Project Area. Cacheu Mangrove Forest National Park (Cacheu Park) has 74,700 hectares, of which 55,247 comprises the Project Area, and was legally established by Decree 12/2000[2] to protect the most relevant patches of mangroves around the Cacheu River estuary in the northern part of Guinea-Bissau. Cantanhez Forest National Park (Cantanhez Park) has 106,500 hectares, of which 90,451 comprises the Project Area, and was legally established by Decree 14/2011 to protect the remaining patches of primary sub-humid forest that form part of a larger area that extends to the south into Guinea Conakry. Figure 1 depicts the geographic position of Guinea-Bissau.

[2] http://faolex.fao.org/docs/pdf/gbs46131.pdf

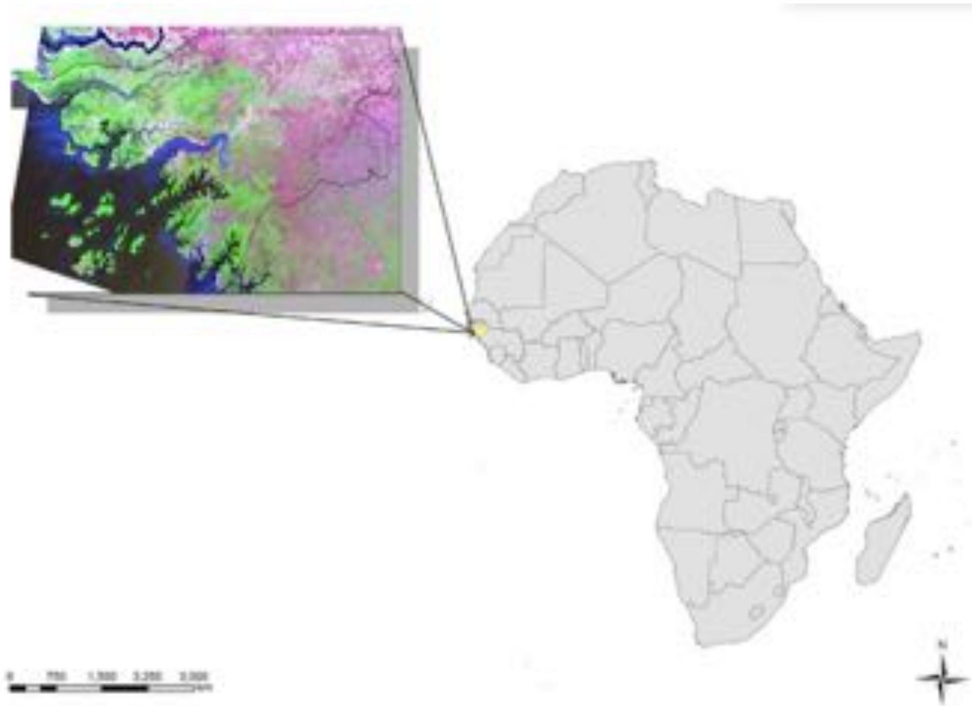


Figure 1. Geographic location of Guinea-Bissau

Both areas are inhabited since, in line with Guinea-Bissau's protected area law, no physical resettlement was required of communities already living within the boundaries of the protected area at the time of its establishment. Cacheu Park has a population density of 38 inhabitants per km^2, with an estimated growth rate of 1.26%. Cantanhez Park has a population density of 21 inhabitants per km^2, with an estimated growth rate of 1.56%[3]. The project area is available for farming[4], mostly shifting agriculture, swamp rice fields and fruit plantation.

Cacheu Park is located at Latitude 12°18'38.37"N and Longitude 16°11'25.19"W, 111 km from Bissau. Cantanhez Park is located at Latitude 11°16'29.85"N and Longitude 14°59'8.00"W, 275 km from Bissau. Both parks are accessible by car from Bissau. Figure 2 shows the geographic location of Cacheu Park, in green, and Cantanhez Park, in blue, in Guinea-Bissau.

[3] Estimated population for both parks (inhabitants/km^2) based on population figures from the 2007 census (INEC, 2007). Available at: http://www.stat-guinebissau.com/
[4] Temudo (2009), Quitino (1971)

Figure 2. Geographic map of Guinea-Bissau (1:500,000 scale) overlaid with Cacheu and Cantanhez Parks limits and the administrative sectors of GB (Source: Junta de Investigações do Ultramar, Portugal, 1962; Administrative regions from Global Administrative Areas, GADM, 2010).

1.10 Conditions Prior to Project Initiation

Guinea-Bissau is one of the poorest countries in the world, ranking 164 out of 169 countries on the United Nations Human Development Index 2010. It has a population of roughly 1.6 million, and its economy is based primarily on farming and fishing activities, which represent some 55 percent of gross domestic product (GDP). Agriculture generates 80 percent of employment and 90 percent of exports (primarily through cashew nuts, the main export), while fisheries represent some 7 to 10 percent of GDP and up to 25-40 percent of public revenues. The country has poor infrastructure and weak social indicators; life expectancy is 48 years, more than two out of every three people live below the poverty line (US$2/day), and one out of every five lives in extreme poverty.

Prior to REDD project initiation, Cacheu and Cantanhez Parks were operational and financed by international donors. In spite of international assistance, since the wind down of the CBMP, IBAP has been forced to operate with a budget deficit.[5]. As a result IBAP had to decrease the scope of its protected area management efforts in line with funding limitations. Two short term, follow-on GEF and World Bank projects have been approved to help keep basic operations running through 2013 and 2015, respectively, while more sustainable financing streams are identified. This assistance totals US$ 2.95 million. Support for park operations includes payment of IBAP salaries, the bi-annual Park Management Committee Meetings and regular/participatory monitoring and surveillance activities. These are complemented by some smaller contributions by other donors. Unfortunately, the execution of new FIAL financed community projects is currently on hold due to the closure of the CBMP and the associated

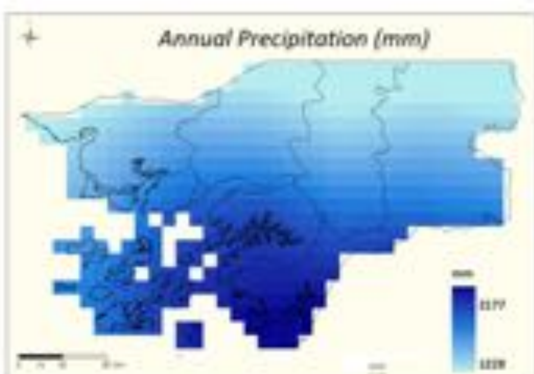
[5] According to IBAP data in 2010 (EUR 177,525) and in 2011 (EUR 54,992).

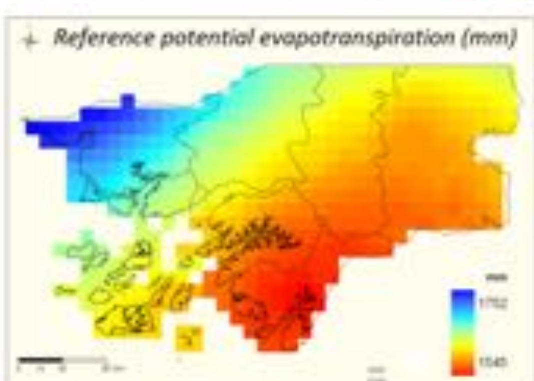
cessation of project-based micro-project funding. Consequently, emissions are expected to accelerate due to the reduction in resources available to keep the parks running. As can be demonstrated, the project has not been implemented to generate GHG emissions for the purpose of their subsequent reduction since, in spite of IBAP efforts, baseline historical deforestation remain relevant. This condition is further described in the Baseline Scenario section (Section 2.4). The present and prior environmental conditions of the area are described below.

Climate

The Guinea-Bissau Climatologic Profile Report (Dias et al., 2007), states that the territory of Guinea-Bissau is inserted in the Inter-Tropical Front (ITF) field of action, characterized by the existence of a terrestrial mass, 5° North on the West African bulge, and an insular part in the Atlantic Ocean. The country weather is mainly conditioned by the position of the territory in relation to the ITF and by the subsidiary actions of semi-permanent cells of high pressure, known as Azores Anticyclone, in the North Atlantic, the Anticyclone of Santa Helena, in the South Atlantic, and the low summer heat that settles over the Sahara.

The country is divided into two distinct climatic regions: the tropical humid sub-Guinean, coincident with the coastal zone, and the tropical Sudanese Region that influences the eastern half of the country. Cacheu and Cantanhez are located in the tropical humid region that is characterized by heavy rainfall (between 1,500 and 2,500 mm per year), average temperature ranges (26,3 ºC) and strong air humidity throughout the year (CNSMC, 2004).





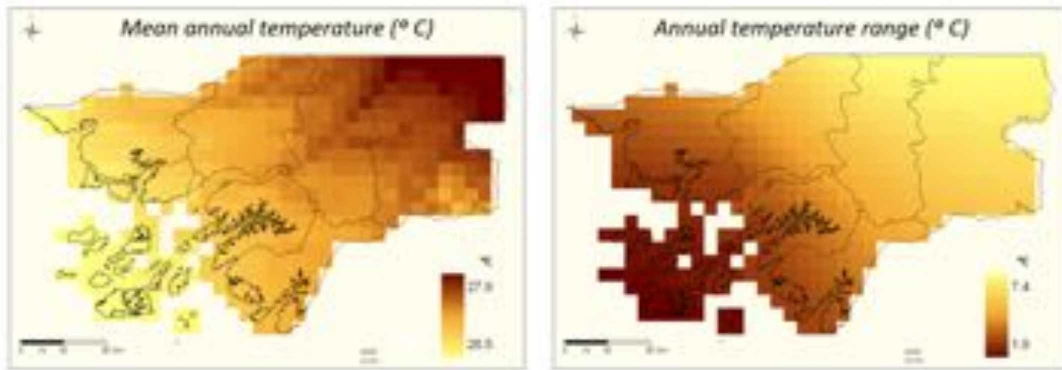


Figure 3. (i) Annual Precipitation, (ii) Potential Evapotranspiration, (iii) Mean annual temperature (ºC) and (iv) Annual Temperature Range (ºC). Source: GAEZ / FAO

The country's climatic profile study (Dias et al, 2007), divides Guinea-Bissau into three rainfall zones: the Southern zone, where Cantanhez is located, (Regions of Tombali, Quinara and Bolama-Bijagos), with an annual average of more than 2,000 mm, the Northwest area, where Cacheu is located (Regions of Bissau, Biombo, Cacheu and Oio), with an annual rainfall average between 1,400 and 1,800 mm and the Eastern Zone (Regions of Bafata and Gabu), whose average annual precipitation ranges from 1,300 mm to 1.500 mm. The maximum rainfall is reached in August, with the monthly average of more than 300 mm. Rainfall is highly seasonal and there is 7-month dry period from December to April.

Hydrology

The Republic of Guinea-Bissau is heavily marked by the presence of estuaries and mangrove areas. Both Cacheu and Cantanhez are located in the coastal area, thus influenced by these characteristics. A dense network of drowned valleys demarcates this area. Almost all of Guinea-Bissau is low-lying and bathed daily by tidal water that reach as far as 100 km inland. Tidal penetration into the interior, facilitated by the country's flat coastal topography, carries some agricultural advantages: the surge of brackish water can be used to irrigate the extensive drowned rice paddies.

Figure 4. Main rivers of Guinea-Bissau.

The coastal zone extends over an area of approximately 180 km and is covered by a network consisting of important water courses. In the first place, the Geba and Corubal Rivers and lochs of the sea in the forms of Cacheu, Mansoa, Rio Grande de Buba, Cumbijã and Cacine Rivers. The Corubal and Geba Rivers are the only freshwater rivers serving as the most important resources of the country's surface water, while Cufada Lagoon is the largest reserve in the country.

Interactions between semi-diurnal tidal currents, littoral drifts and the effects of estuaries greatly influence the degree of the kinematics of the area, resulting in the accumulation of sediments promptly intercepted by arrows sand. The project area is covered by a hydrographic network that consists of the flowing streams: the Cacheu, the Cumbijã and the Cacine Rivers branches and estuaries. The Cacheu River, the most relevant of the three, has total length of about 257 km. One of its major tributaries is the Canjambari River. Cacheu River is navigable to large (2,000 ton) ships for about 97km in, and to smaller vessels much further.

Topography and Soils

The morphology of the territory of Guinea-Bissau is basically plains, with most of the country being below the elevation of 50 meters. Coastal zones, North and South, are mostly lowlands. Thus with the high tidal ranges that occur, reaching 6 meters, large areas of coastal areas are exposed to its effects. The plains cover a large part of the territory in the Central and Northeast Regions of the country. The inner Southeast zone is the most rugged part of Guinea-Bissau, other than the hills of Boé, the highest part of the territory, which does not exceed 298 meters in altitude (Mota, 1954).

In Guinea-Bissau the following types of soil can be identified: Ferralsoils, Plintosoils, Sandysoils, Hydromorphicsoils and other types of substrate (bouali, mud and sands). In the table below, the area occupied and percentage occupancy for each soil type is shown.

Table 1. Soil Type in Guinea Bissau

Soil Type	Area (ha)	% Occupacy
1. Ferralsoils	1,960,000	62
2. Plinthosoils	550,00	17
3. Sandysoils	20,00	1
4. Hidromírtic Soils	650,00	20
4.1 Gleisoils	150,00	5
4.2 Reverine	500,00	15

The soil groups most representative in Guinea-Bissau are Ferralsoils, Plintosoils, Gleysoils, and Fluvisoil (Teixeira, 1962). Ferralsoils, which in Teixeira's nomenclature correspond to ferralitic and fersialitic soils, cover most of the northern and southern regions of Guinea-Bissau. They are among the deepest soils in the country, but are relatively poor in organic matter and in mineral nutrients. The natural vegetation of Guinea-Bissau Ferralsoils is mainly open forest, though, when weather conditions allow, can develop dense sub-humid forest. This is the case of Cantanhez, with more than 2,000 mm of annual rainfall and deep soils create the ecological conditions that favor the establishment of the sub-humid forest. In the coastline and lower river areas there is occurrence of Fluvisoils. These soils are fine texture of fluvial origin, often affected by salt or brackish water and, therefore, high in sodium. According to Teixeira (1962), they correspond to hydromorphic soils derived from marine alluvium. The natural vegetation on these soils consists of mangroves. These are fertile soils and used for growing rice in salty water rice fields.

Figure 5. Soil Map of Guinea-Bissau. Source: Teixeira, 1962.

In Cacheu National Park, 75% of soils are Fluvisols/Gleysols and 25% Ferrasols. In Cantanhez National Park, 41% are Fluvisols/Gleysols, 58% Ferrasols and 2% Arenasols.

Vegetation and Ecosystems

Guinea-Bissau is rich in flora and fauna resources, thanks to its extremely varied vegetation cover (dense and open forests, savannas, palm groves and mangroves). It has an important Protected Areas Network of 470,000 ha, equivalent to about 13% of the total area of the country. Dense forests cover the coastal lowlands; mostly swamp forests, while the interior is savanna covered, with gallery forests along streams.

The coastal area, subjected to high tidal ranges, has a dual importance: environmental and socio-economic. Its ecological importance is justified by the fact that it encompasses diverse ecosystems rich in terms of biodiversity resources such as forest, mangrove, freshwater, intertidal and marine ecosystems. The rare and endemic species, as well as the ones that migrate from Europe, Asia, and from the Sub-Region choose this area for shelter, feeding and reproduction. Its economic potential and social importance derives from that ecological richness, given that the exploitation of such biodiversity resources contributes greatly to the economy of the country, notably through forest exploitation, fisheries, agriculture and tourism, among other activities. This explains why about 70% of the population is concentrated in coastal areas, depending almost entirely on the resources of its ecosystem.

Cantanhez holds the latest patches of dense mature sub-humid forest, which form part of a larger area that extends to the south, into Guinea Conakry. Cacheu holds the most relevant patches of mangroves in the northern part of GB, which is located around the Cacheu River estuary. The other predominant vegetation covers are open forest, savannahs and palm groves.

Flora diversity in the country is relatively high, with occurrence of around 1,500 species and subspecies (Catarino et al. 2006, 2008). In the regions with higher rainfall, in the south of the territory, in particular the Cacheu region, the sub-humid forest can reach 30 meters (Catarino et al. 2012) with Anisophyllea laurina, Dialium guineense, Hunteria umbellata and Strombosia pustulata being to most characteristic species. Open forests can be found all round the territory, with forest cover between 40% and 60%. Most common species are Afzelia africana, Daniellia oliveri, Detarium senegalense, Khaya senegalensis, Parkia biglobosa and Pterocarpus erinaceus (Dinz, 2012). Palm groves develop in deep soils around wet valleys, with dominance of Elaeis guineensis. Wooded Savannahs can be found all over the country, but are more relevant in the Northern and Eastern parts of Guinea-Bissau. Forest cover is around 10% to 40%. Amongst the most common species there are Borassus aethiopum in deep soils, Erythrina senegalensis, Guiera senegalenses, Piliostigma thonningii, Strychnos spinosa and Terminalia macroptera. Mangroves can be found on the coastline and on river estuaries. In Cacheu, the species found are of global relevance being the largest contiguous mangrove forest in West Africa. Most common species are Avicennia germinans and Rhizophora mangle (Diniz, 2012).

The Guinean marine and coastal zones are represented by a variety of ecosystems (marine, transitional and terrestrial) high productivity and rich in biodiversity resources. Considering the high concentration of nutrients due to a huge potential of mangrove and other favorable environmental conditions such as temperature gradients and variable salinity and also the exceptional conditions of shelter support reproduction and initial feeding of most species inhabiting oceans and coastal environments became a major focus of attention. Most of the shoreline and numerous estuaries in Guinea-Bissau serve as spawning and development for some pelagic fish. Most of these pelagic species migrates along the West African Coast, and it is therefore very difficult to specify the potential annual production for Guinea-Bissau alone.

This area, in addition to their national strategic importance, also has an international ecological function of great importance, serving as habitat for reproduction, growth, feeding and refuge for several species of cultural, symbolic and economic interests like those classified as rare or endangered at the world level. Species most noted in this zone include: the manatee (Trichechus senegalensis); Hippos (Hippopotamus amphibius); Nile crocodiles (Crocodylus niloticus); Leatherback sea turtle (Dermochelys coriacea); Olive Ridley sea turtle (Lepidochelys olivacea); Hawksbill sea turtle (Eretmochelys imbricate); Green sea turtle (Chelonia mydas) and Loggerhead turtle (Caretta caretta); different species of mammals, particularly primates: Bijagó Monkey (Cercopithecus petaurista); Western Red Colobus Monkey (Poliocolobus badius); Nobel Monkey polykomos Colobus; Chimpanzee (Pan troglodytes versus); and other mammals such as: elephant(Loxodonta Africana); African

Buffalo (Syncerus sp); White Boca antelope (Sable equinus koba) and Defassa waterbuck (Kobus ellipsiprymnus defassa).

During particular seasons, the coastal region also serves as a breeding area and migration route for a large number of migratory birds from Europe, Asia and the sub region, Guinea-Bissau, in general and in particular the Bijagós Archipelago, is after Banc d'Arguin in Mauritania, the second most important place in West Africa, receiving up to 700 thousand Palearctic migratory birds of various species annually. Birds that can be encountered breeding include: African Darter or Snakebird (Anhinga rufa); White Heron or Great Egret (Egretta alba); Little Heron (Egretta garzetta); African Sacred-ibis (Threskiornis aethiopicus); African spoonbill (Platalea alba); gray pelican (Pelecanus rufescens); Grey-headed Gull (cirrocephalus); Slender-billed Gull (Larus genei); Large Tern (Sterna Caspian); Royal Tern (Sterna maxima); Gull-billed tern (Sterna nilotica) and the gray parrot (Psittacus timneh). A large part of the coastal zone and their habitats are thus included in the network of Important Areas for the Birds - IBA (T. Dodman and Mr SA 2005).

Relevant Historic Conditions

After independence the country enjoyed only a brief period of stable constitutional rule (1974-1980). In late 1980, the first government was overthrown in a relatively bloodless coup led by Prime Minister and former armed forces commander João Bernardo “Nino” Vieira, who would rule this country for 19 years from 1980 to 1999. In the period between 2000 and 2013, Guinea-Bissau experienced considerable political and military upheaval with elections being undertaken successfully in June 2014. Decades of week institutional capacity lead to total absence of rules over natural resources in the country. International donors allowed the country to establish, in 2004, an independent body to managed and protect the forests and the biodiversity the country contain. IBAP, the Institute for Biodiversity and Protected Areas, successfully created the National System of Protect Area (SNAP) and, although with great struggle, has been able to establish infrastructure and train human resources to support its mission. This REDD project is part of a broader strategy put in place by IBAP to reduce the country’s dependency on foreign resources to manage its protected areas.

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

The project responds and complies with all relevant national and local laws and regulations, most importantly: the Constitution of the Republic of Guinea-Bissau, the Forestry Law, the Land Law, the laws related to national parks and protected areas including the Protected Areas Law and the laws that established Cacheu National Park, Cantanhez National Parks and IBAP. At local level, the Internal Regulations of Cacheu and Cantanhez are also relevant and are included in the analysis. Finally, in concern of worker rights, the national labor law (Lei Geral do Trabalho) is also included.

- Constituição

  The constitution of the Republic of Guinea Bissau, clearly establishes the rights over the territory and the rule of the government over natural resources, including forests. More specifically, on Article 8º, §2 “The Republic of Guinea Bissau is sovereign over all natural resources in its territory”, and on Article 10º “executing exclusive rights in maters of conservation and exploitation of natural resources. Finally, Article 12º, §2 states that “Are State property the soil, the subsoil, the water, the mineral resources, the main energy sources, the forestry richness and the social infra-structures. The proposed REDD project is proposed by IBAP with specific power granted by the State according to the Decree 02/2005 (IBAP Establishment Decree) to manage the protected areas and safeguards the national biodiversity.

- Lei Florestal (05/2011)

  The Forestry Law was published in 2011 with three objectives, (i) promote the sustainable management of the resources that composes the forestry resources, (ii) optimize the contribution of the natural forests to the socio-economic and cultural development and the environmental protection and (iii) to improve the livelihood of the population. The law defines on its Article 14º that “all cut of tree in the forestry domains of Guinea Bissau for agricultural purposes, is subjected to approval and site visit by the Forestry Department (DGFF). The project will support the Forestry Law by monitoring, on the ground, any deforestation in the project area and supporting forestry protection enforcement through its parks guards and patrolling activities.

- Lei Quadro das Áreas Protegidas (3/1997) and its revision (5-A/2011[6]):

  The Protected Areas Law establishes the general objectives of the Protected Areas in Guinea-Bissau. The law defines inter alia the role of IBAP; the governance structure for the parks (IBAP, Park´s Director and the Management Committee) and the development and update of the Parks Management Plans every 10 years. On its Article 2º, the law lists its objectives. As discussed in the baseline section, Guinea Bissau cannot enforce this legislation given its budgetary constraints and the necessity to invest in other priority areas like infrastructure and health. The project will assist IBAP in reaching the objectives of the Protected Areas Law, more specifically in safeguarding habitats, animal and vegetal species under threat, in conserving and restoring habitats of the migratory fauna and its corridors (in special in the coastal area), to defend, conserve and value the traditional way of life that does not harm the ecological patrimony and to promote and support the sustainable use of natural resources by the communities. The project is also in compliance once its activities are integrated within the broader IBAP plans and activities. In fact, this project is a pilot to IBAP evaluate how REDD can assist Guinea Bissau in protecting its relevant natural resources.

- Lei da Terra (05/1998)

  The land law, from April 23rd of 1998, nationalizes the soil in all national territory, giving to the State the property over all land in the country. The law, on its Article 2º, established that land is property of the State but accessible to all people in the country. More important, the law recognizes the customary law of communities stating the relevance of the traditional land use, the culture and practices carried from generation to generation that established reciprocal rights and obligation in the communities. The REDD project was designed based on community management practices already

[6] Approved by the Ministry Council in March 1st 2011. Issued on the Boletim Oficial number 9, 2011.

recognizing this complex context. Whilst IBAP is, by law, the ruler of the Protected Areas, a much complex social relationship exists in the communities with traditional leadership and a long established participatory arrangement governing daily practices. Both the Protected Areas Law and each park establishment decree recognize the park committee as the body able to take decisions and the local level. Therefore, Internal Regulations are decided and voted at this sphere avoiding future conflicts and granting agreement and participation of the community. The REDD Project, aware of this social structure, was designed to follow community decisions, in special, the benefit sharing mechanism (FIAL) uses a participatory approach to decide who will receive money and where this money will be invested. Communities can prioritize investments and make collective decision. The REDD project recognizes that its success depends on community engagement and on ways to support behavioral change, in special related to traditional extensive agricultural practices that have been deforesting both outside and inside the parks.

- Cacheu Park Establishment Decree (12/2000[7])

  Creates Cacheu National Park, sets its boundaries and zones, establishes the management structure of the park, legal activities and penalties. The project was design to follow the park's boundaries in order to support IBAP in managing and conserving Cacheu National Park. The proposed REDD activity was though to assist Cacheu in reaching its long-term objective (Article 2º).

- Cacheu Internal Regulation

  An Internal Regulation is a legal instrument established by the Protected Areas Law and by each national park decree to clarify and enforce local rules that must follow both the ecological aspects of the area and the social aspects of the communities that live on the same area. The Internal Regulation is collectively agreed at the Park Management Committee made of representatives of the Government, IBAP, Park Director and other relevant staff and the local community. Cacheu Internal Regulation sets the objectives of the park, in line with Decree 12/2000 but is more specific as it forbids, inter alia, tree cut in all park, fire use during the dry season and mangrove cut. As with other laws previously presented, the project goes hand and hand with the Internal Regulation objectives and, in fact, strengthens IBAP's enforcement capacity reducing deforestation inside the park borders.

- IBAP Establishment Decree (02/2005[8])

  Establishes the Institute of Biodiversity and Protected Areas (IBAP). In particular it defines as one of IBAP´s competencies: Manage the Protected Areas and safeguard the endangered species through implementation of the strategy and action plan for the

[7] Approved by the Ministry Council in November 30th 2000. Issued on the Boletim Oficial number 49, 2000.
[8] Approved by the Ministry Council in March 9th 2005. Issued on the Boletim Oficial number 11, 2005.

conservation of biodiversity[9]. The project is compliant with the law once the project proponent, IBAP, is the institution with legal mandate to manage the project area. As established by the decree, is IBAP's responsibility to "implement strategies and action plans for the conservation of biodiversity". This REDD project is a relevant part of IBAP strategy to guarantee sustainable and stable flow of funds to financially support its activities in Cacheu and Cantanhez National Parks.

- Cantanhez Park Establishment Decree (14/2011[10])
  Creates Cantanhez National Park, sets its boundaries and zones, establishes the management structure of the park, legal activities and penalties. The project was design to follow the park's boundaries in order to support IBAP in managing and conserving Cantanhez National Park. The proposed REDD activity was though to assist Cantanhez in reaching its long-term objective (Article 2º).

- Cantanhez Internal Regulation
  An Internal Regulation is a legal instrument established by the Protected Areas Law and by each national park decree to clarify and enforce local rules that must follow both the ecological aspects of the area and the social aspects of the communities that live on the same area. The Internal Regulation is collectively agreed at the Park Management Committee made of representatives of the Government, IBAP, Park Director and other relevant staff and the local community. Cantanhez Internal Regulation sets the objectives of the park, in line with Decree 14/2011 but is more specific as it forbids, inter alia, tree cut in all park, fire use during the dry season and mangrove cut. As with other laws previously presented, the project goes hand and hand with the Internal Regulation objectives and, in fact, strengthens IBAP's enforcement capacity reducing deforestation inside the park borders.

- Lei Geral do Trabalho (02/1986)
  The labor law was approved on April 5th 1986. It governs all work relationships and also established that other relationships not governed by law must be derived from Work Contracts. IBAP operates in accordance with such law, keeping registries and following its legal obligations in relation to workload, payment of social contributions and taxes. Any future worker, hired by IBAP to support the REDD initiative; will also follow the labor law. So far, no local worker had been hired by the project as the project activities had not started.

1.12 Ownership and Other Programs

1.12.1 Right of Use

The Project Area is under the institutional control of the Institute for Biodiversity and Protected Areas of Guinea Bissau (Instituto da Biodiversidade e das Áreas Protegidas – IBAP). IBAP

[9] Art. 4º, (b) "Gerir as áreas protegidas e as espécias ameaçadas através da estratégia e do pano de acção para a conservação da biodiversidade".
[10] Approved by the Ministry Council in February 22nd 2011. Issued on the Boletim Oficial number 8, 2011.

was founded in December 2004, under Decree n^{o} 2/2005, Chapter II, Article 3$^{o:}$ This Decree defines IBAP's mandate[11] to include the following:

a. Recommend, coordinate and execute the policies and actions related to biodiversity and protected areas in all national territory;

b. Promote and protect the ecosystems, biodiversity and protected areas and, to promote by all human and technical available means, the socially and economically sustainable use of the natural resources within the national territory, including the continental waters and the sea.

IBAP has legal rights over National Parks and its resources. Communities hold traditional land use rights but, in Guinea-Bissau, private ownership of land is not allowed by law. Therefore, rights of use in Cacheu and Cantanhez are controlled by IBAP, which coordinates park committee meetings for collaborative decision-making (following Parks Internal Regulation), enforce land use regulations and apply penalties when necessary. These rights are established by law (Decree nº 5/2011 – Protected Area Law) as follows:

- Chapter IV – Management of Protected Areas: grant IBAP the power over new buildings establishment (Article 21º), Economic Activity Control (Article 22º), Exploitation Titles (Article 23º) and Coastal and Riverine Protection (Article 24º). All mentioned articles establish that IBAP has rights to permit or request environmental impact assessment prior to the execution of such activities.

- Chapter VII – Monitoring of Protected Areas: grant IBAP staff legal power to enforce use rights.

In addition, the Internal Regulations of each park (Cacheu and Cantanhez) reiterate that IBAP has rights to control use and regulate economic activities in National Park areas (Article 19º in Cantanhez Internal Regulation and Article 24º in Cacheu Internal Regulation).

1.12.2 Emissions Trading Programs and Other Binding Limits

The project is being developed in a Least Developed Country (LDC) where no legally binding limits on GHG emissions exist. The project is voluntary and will not be used for compliance with an emissions trading program.

1.12.3 Other Forms of Environmental Credit

No other environmental credit has or intends to be generated by the project. The project is eligible to participate in the following programs to create another form of GHG-related environmental credit:

- Plan Vivo

- ISO 14.064 Part 2

[11] http://guinebissau.adbissau.org/inormacoes/Relatorio.pdf

- American Carbon Registry (ACR) Standard

The project may seek co-benefits assurance by a third party validator in the Climate, Community and Biodiversity (CCBA) or the SocialCarbon Standard in the future. CCBA and SocialCarbon do not issue credits, they are a combined certification to be used jointly with the VCS Standard to certify further sustainability impacts due to the implementation of the project activity.

1.12.4 Participation under Other GHG Programs

The project is not registered or seeking registration under any other GHG Program.

1.12.5 Projects Rejected by Other GHG Programs

The project did not try registration under any other GHG Program, and hence, had not been rejected by any other GHG Program.

1.13 Additional Information Relevant to the Project

Eligibility Criteria

The project activity comprises two areas[12] – Cacheu Mangrove Forest National Park and Cantanhez Forest National Park – both with similar legal frameworks and baseline cases. The table below indicates the most plausible VCS-eligible activity for the project activity.

Step 0. Identification of the most plausible VCS-eligible activity

Is the forest land expected to be converted to non-forest land in the baseline case?			
YES Is the land legally authorized and documented to be converted to non-forest?		NO Is the forest expected to degrade by fuel wood extraction or charcoal production, in the baseline case?	
YES Avoided planned deforestation	NO Avoided unplanned deforestation	YES Avoided forest degradation	NO Proposed project is not a VCS REDD activity currently covered by the module framework

[12] World Database on Protected Area (WDPA). Available at: http://www.protectedplanet.net/sites/Cantanhez_Forest_National_Park and http://www.protectedplanet.net/sites/Rio_Cacheu_Mangroves_Natural_Park

Forestland is expected to be converted to non-forest land in the baseline case as will be demonstrated in the Baseline Scenario section (2.4) of this VCS PD. The project activity will avoid unplanned deforestation, an eligible VCS activity.

Leakage Management

FIAL is expected to be a strong leakage management tool capable of maintaining or increasing local population livelihoods through the introduction of new technological practices and alternative activities. In the event of residual leakage, emissions will be captured through the project's MRV system. Leakage management and the justification as to why Project Proponent expects Leakage to be minor are described below:

The nature of deforestation is subsistence agriculture and hence not prone to much displacement (not much mobility). In both parks, subsistence agricultural activities are the main drivers of deforestation. In Cacheu, the most representative ethnic groups are Manjacos, Cobianas and Felupes. These two groups use agricultural practices with shifting cultivation and plantation of rice, collection of oil and other products from palm groves and conversion of forest into savannah-orchards. The main agricultural product is rice, and during the last decades, plantation of fruit trees has increased (in particular cashew[13]). In Cantanhez, the local population consists of the Balanta, Nalu, Tandas, Djacancas and Fula ethnic groups. As in Cacheu, rice is the main agricultural product. In this area, the development of fruit plantations is also observed (particularly bananas).

The project design is targeted to neutralize the drivers in a way that avoids leakage. While there is a risk that leakage could arise from the displacement of the subsistence agricultural activities, it is anticipated that project funds, flowing via the FIAL micro-project financing mechanism, can provide the necessary means to improve agricultural practices, create additional income from fruit processing and other extractive activities, thus ensuring that the deforestation activities will not be transferred to other areas.

So far, FIAL has demonstrated excellent performance. Micro-projects used simple, innovative technologies designed to increase incomes and improve social infrastructure while curbing deforestation, improving drainage, conserving water and protecting water sources, preserving mangrove zones and building local ownership of the principles and practices supporting sustainable fisheries and coastal management. Not all investments had or were intended to have direct conservation impacts, e.g., schools, but FIAL conveyed a strong message through project-financed communications campaigns about the link between the environment and sustainable livelihoods, the meaning of conservation per se, and the need for organized, community-based approaches. Improved educational opportunities and literacy were seen as longer-term investments in sustainability. Priority was given to activities that also help reduce poverty and empower poorer communities.

During its implementation stage, FIAL's goal was that at least 75% of the micro-projects funded would satisfactorily achieve their objectives (based upon an independent evaluation).

[13] INEC (2007), during the 2007 census, 48% of the respondents listed cashew nuts as an agricultural product at the household.

According to a series of evaluations[14], FIAL's success rate reached 81,3% of the projects; a total disbursement of 1,47 million USD was made across 129 projects. An important example of institutional/stakeholder collaboration for conservation and sustainable development ends was the rapid and effective FIAL-financed pilot effort to restore seawater–flooded lowland rice paddies threatening the subsistence and livelihoods of 3,000 people as well as the forested upland areas vulnerable to invasion and deforestation by these same groups if the paddies were not reclaimed.

The project boundaries are drawn according to methodological requirements so it captures any displacement to the Leakage Belt. Although not expected to be significant, the project boundaries, more specifically the Project Area and Leakage Belt, have been designed to allow detection of potential leakage, ensuring that any residual leakage is captured through the project's MRV system.

Commercially Sensitive Information

No commercially sensitive information has been provided.

Further Information

Not applicable

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

VM0007 – REDD Methodology Framework (REDD-MF). Version 1.4

The following Modules and Tools are also applied:

Module	*ID*	*Version*	*Choice*
REDD Methodology Framework	REDD-MF (VM0007)	Version 1.4	Always Mandatory
Methods for monitoring of greenhouse gas emissions and removals.	M-MON (VMD0015)	Version 2.1	Always Mandatory
Tool for Demonstration and Assessment of Additionality in VCS AFOLU Project Activities.	T-ADD (VT0001)	Version 3.0	Always Mandatory
Tool for AFOLU non-permanence risk analysis and buffer determination.	T-BAR	Version 3.2	Always Mandatory
Estimation of uncertainty for REDD project activities	X-UNC (VMD0017)	Version 2.0	Always Mandatory
Methods for stratification of the project area.	X-STR (VMD0016)	Version 1.0	Always Mandatory
Estimation of baseline carbon stock changes and greenhouse gas emissions from unplanned deforestation.	BL-UP (VMD0007)	Version 3.2	Mandatory for Unplanned Deforestation

[14] The World Bank (2011) Final Evaluation Report of CBMP, Vaz, d´Alva and Badji (2008, 2009) Evaluation of FIAL Micro-Projects, and d´Alva (2011) Final Evaluation of FIAL Micro-Projects

Estimation of emissions from activity shifting for avoided unplanned deforestation.	LK-ASU (VMD0010)	Version 1.0	Mandatory for Unplanned Deforestation
Estimation of carbon stocks in the above and belowground biomass in live tree and non-tree pools.	CP-AB (VMD0001)	Version 1.1	Always Mandatory
Estimation of greenhouse gas emissions from biomass burning	E-BB (VMD0013)	Version 1.0	Always Mandatory
CDM "Tool for testing significance of GHG emissions in A/R CDM Project Activities".	T-SIG	Version 1.0	Applied to justify selection of carbon pools and emission sources

2.2 Applicability of Methodology

The project is compliant to the following applicability conditions:

REDD-MF

- Land in the project area has qualified as forest at least 10 years before the project start date as can be seen in the baseline (2000-2010) maps.
- The project area includes forested wetlands (Mangrove Forest) and terrestrial forest. Based on Teixeira (1962) soils map, it was estimated the proportion of the soil types in Cacheu: Fluvisols/Gleysols (75%) and Ferralsols (25%), and Cantanhez: Fluvisols/Gleysols (41%), Ferralsols (58%) and Arenasols (2%). Mangrove areas are mainly composed of Fluvisols/Gleysols whist the terrestrial forest is found at Ferralsols area. Therefore, forested wetlands in the project area do not grow on peat (Histosol).
- IBAP has control over Cacheu Mangrove Forest National Parka and Cantanhez Forest National Park and ownership of the carbon rights for the project area as discussed in the legal background (1.11) and right of use (1.12.1) sections. Control can also be demonstrated by the constant presence of IBAP personnel in the Project Area.
- Baseline deforestation in the project area fall within the category unplanned deforestation (VCS category AUDD). Deforestation in Cacheu and Cantanhez is not allowed as demonstrated in the Legal Section (1.11) of this PD;
- The Community Based Avoided Deforestation Project in GB will renew its baseline every 10 years after the start of the project.
- Areas within the project boundary are not registered or seeking registration under the CDM or other carbon-trading scheme.
- Post-deforestation land use is described by Temudo (1998). After deforestation land is converted to agricultural use and enters a shifting cultivation cycle composed of 2 years cropland and 5 to 6 year fallow period.
- Areas where post-deforestation land use constitutes reforestation (e.g. Cashew Plantation) were excluded from the baseline analysis (Winrock/IICT, 2012)

- Leakage avoidance activities do not include agricultural lands that are flooded to increase production or Intensification of livestock production through use of “feed-lots” and/or manure lagoons. Section 1.13 discusses the Leakage Management clearly demonstrating the leakage avoidance measures to be put into practice.

BL-UP

- Baseline agents of deforestation are the local population living within the Project Area and clear the land for crop production (Subsistence Agriculture) according to traditional land use practices not amounting to large-scale industrial agriculture activities (Winrock/IICT, 2012);

- Areas where post-deforestation land use constitutes reforestation (e.g. Cashew Plantation) were excluded from the baseline analysis (Winrock/IICT, 2012)

- Fuelwood collection is small scale and related to the energetic demand of the local households. Casarim et al. (2010) using data published by the FAO showed no increase in threat to forest carbon stocks through either production or consumption of fuelwood in the country. Statements from the Cacheu Park Management Plan 2008-2018 (IBAP, 2008) and the Coastal and Biodiversity Management Project Appraisal Document (PGBZC, 2004) supported the decision of not including the analysis of BL-DFW (VMD0008) and LK-DFW (VMD0012) in this assessment. According to these two documents, for domestic consumption (cooking) around 90% of households use firewood mainly from down dead wood, there is little use of charcoal (approximately 11%) (PGBZC, 2004) and all extraction for commercial purposes is officially forbidden under the park’s regulation (IBAP, 2008).

LK-ASU

- Applies as far as BL-UP is used.

CP-AB

- Applicable to all forest types and age classes;

- Aboveground and Belowground tree biomass pools has been accounted by the field inventories;

- Non-tree aboveground biomass is excluded since stocks are expected to be higher in the project scenario.

E-BB

- Since fire may occur ex-post the module is applied in the monitoring plan to account GHG emissions.

M-MON

- The module is always mandatory. The ex-ante stratification is fixed for this baseline and will not be changed.

X-STR

- Stratification of pre-deforestation forest classes used CARBOVEG-GB maps as ancillary data and as proxy for potential biomass classes and area estimation.

X-UNC

- A precision target of 95% confidence interval equal or less than 15% of the recorded values has been used to determinate the number of plots (Winrock/IICT 2012);

- Total net GHG emission reductions are adjusted according to the estimated total uncertainty in baseline scenario. Uncertainty in the baseline in Cacheu totalled 16% and in Cantanhez 11%.

2.3 Project Boundary

Step 1. Definition of the project boundaries

a. Geographical boundaries

Following the module BL-UP, the spatial delineation of each feature (Reference Region, Project Area and Leakage Belt) is presented for the two parks that constitute the Project Activity (Figure 3 and Figure 4). The definition of the Reference Region and the Leakage Belt was performed based on detailed analysis of the factors to be characterized (such as agents of deforestation) or quantified (such as proportion of forest types). The main drivers of land cover change in GB are tied to subsistence agriculture activities, and vary geographically with ecological, socio-economic and ethnical/cultural characteristics.

The RRD (Reference Region for Projecting Rate of Deforestation) was the only Reference Region defined since the configuration of deforestation in the Project Area is transition and the BL-UP requirement is achieved[15]. The RRD does not need to be contiguous with, and shall not encompass the Project Area or the Leakage Belt, and its total area must be forested at the start of the historical reference period. The area around Cacheu Park has the same ecological characteristic of those present within the Park, including the proportion of forest types observed in ancillary maps. The RRD includes forestlands spread along the administrative sectors of Cacheu, Caio and Cachungo. Wetlands of the region of Oio, along the margins of the rivers Cacheu and Mansoa, were also included to guarantee a similar proportion of mangrove and soil type. The area around Cantanhez includes most of the south western part of GB, which is the region with the most similar ecological and socio-economic conditions to those present in the Park. It includes the forests of the sectors of Buba, Empada and Catio

[15] Location analysis is not required where it can be shown that ≥ 25% of the project geographic boundary is within 50m of land that has been anthropogenically deforested within the 10 years prior to the project start date

and also those in the south of the administrative sector of Cacine. Additionally, the wetlands in the northern region of Quinara, along the margins of the Geba River, were also included in the RRD to ensure a similar proportion of mangroves.

In Cacheu, the Leakage Belt was established with some relaxation given that the proportion of mangrove is inevitable higher in the Project Area. The Leakage Belt boundary was adjusted to consider the remaining mangroves in the surrounding areas, and upstream on the Cacheu River[16]. In Cantanhez, the minimum area criterion was achieved. The Leakage Belt boundary was influenced by the distribution of closed forests in the region and the methodological requisite of similar proportion of the same forest type.

Finally, as described on section 1.9, the Project Area is constituted of Cacheu Mangrove Forest National Park and Cantanhez Forest National Park. The parks boundaries are presented by the solid polygons on Figure 6 and Figure 7.

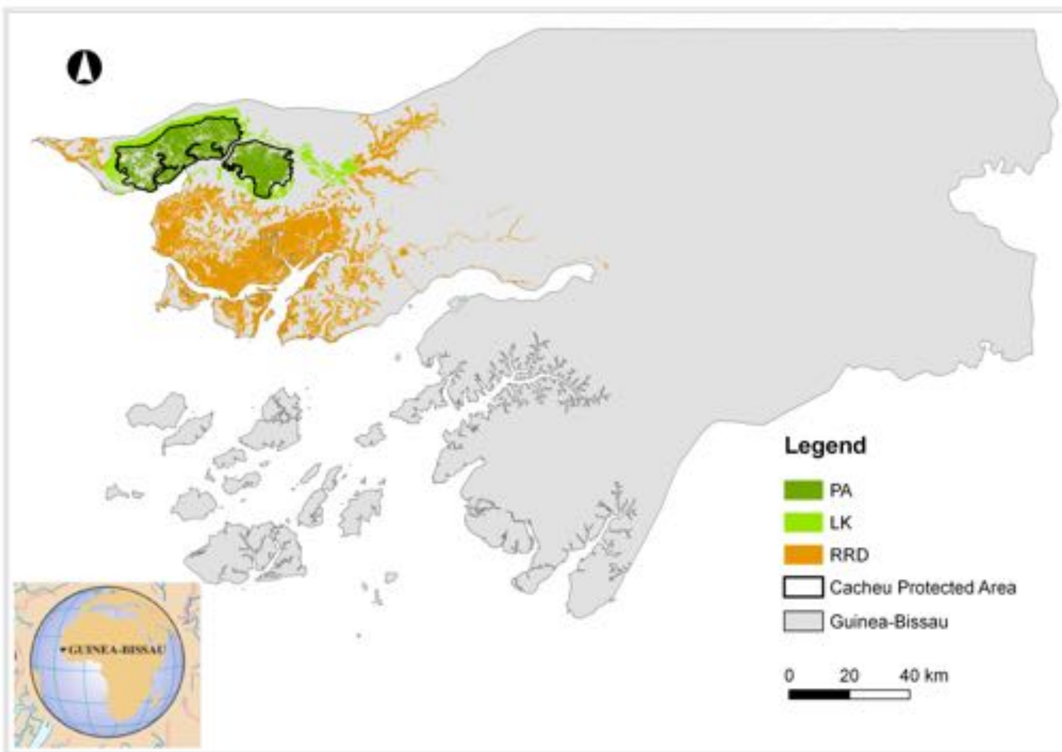


Figure 6. Cacheu Project Area (PA), Leakage Belt (LK) and Reference Region for projecting rate of Deforestation (RRD) boundaries

[16] As anticipated in the BL-UP: "The minimum leakage belt area shall be equal to at least 90% of the area of the project. However, if identification of a forested area of this size (meeting criteria a to g) is impossible then the following guidelines shall be followed: Available forest area meeting criteria a – g > 75% Project Area (with similarity requirements in d and e relaxed to ±50%)"

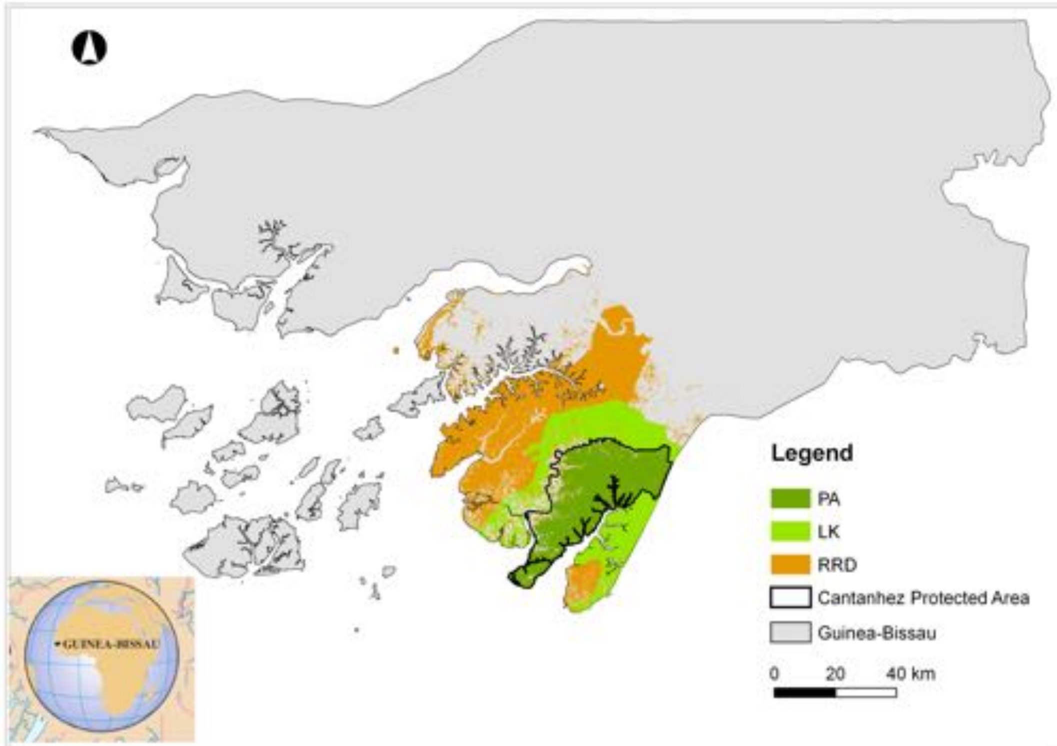


Figure 7. Cantanhez Project Area (PA), Leakage Belt (LK) and Reference Region for projecting rate of Deforestation (RRD) boundaries

b. Temporal Boundaries

The historical reference period is the temporal domain from which information on historical deforestation is extracted, analyzed and projected into the future. The historical reference period was established in compliance with VMD0007 methodological requirements of three points in time of no less than 3 years apart covering no more than 12 years. Three spatial data points were selected: 2002, 2007 and 2010.

c. Carbon pools

The carbon stock assessment was designed in accordance with the protocol established in the module VMD0007 (BL-UP) and VMD0001 (CP-AB). Sampling was designed to accurately account for the total biomass carbon stocks in the selected carbon pools and stratified using ancillary data provided from satellite imagery and following VMD0016 (X-STR). The assessment relied on both data collected in the CARBOVEG-GB Project and new data sampled in 2010 and 2012 by Winrock International and the Portuguese Tropical Research Institute (IICT).

Aboveground and belowground tree biomass carbon was estimated for the following strata:

- Closed Forests
- Open Forests

- Mangroves
- Savannah

The remaining carbon pools were conservatively excluded following T-SIG[17]. VMD0017 (X-UNC) was applied to evaluate precision and define the number of plots to reach the desired target of 15% (CI 95%). A total of 261 plots were considered in the carbon stock analysis based on data from the fieldwork developed by Winrock and IICT in 2010 and 2012 and the CARBOVEG-GB in 2007, 2008 and 2009.

Carbon Pools	Included?	Justification/Explanation
Aboveground	Included	Significant carbon pool. Carbon stock change in this pool is relevant.
Belowground	Included	Significant carbon pool.
Dead wood	Excluded	Conservatively excluded
Harvested wood products	Excluded	Conservatively excluded. No long term wood product activities observed in the project area.
Litter	Excluded	Conservatively excluded
Soil organic carbon	Excluded	Conservatively excluded. In the event of conversion of mangrove systems into wetland rice cultivation, the soil carbon stocks will likely not decrease because the flooding regime will be maintained and the wetland area is enclosed

d. Sources of greenhouse gases

Potential sources of GHG emissions in REDD projects could arise from the use of fertilizers, biomass burning and use of fossil fuels in vehicles and stationary equipment. Non-CO2 gases that can be emitted from woody biomass burning are included in the project emissions in case if fire occurs. Other project emissions are not considered since those sources are not relevant to the proposed REDD project.

[17] Tool for testing significance of GHG emissions http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-04-v1.pdf

Source		Gas	Included?	Justification/Explanation
Baseline	Agriculture	CO_2	Included	CO_2 emissions are fully accounted in the carbon stock changes in the aboveground and belowground tree biomass pools.
		CH_4	Excluded	Non-CO_2 emissions from agriculture are conservatively omitted, because such emissions are expected to be greater in the baseline than in the project scenario, as deforestation followed by agricultural practices is expected to decrease.
		N_2O	Excluded	
Project	Biomass Burning	CO_2	Excluded	CO_2 emissions are fully accounted in the carbon stock changes in the aboveground and belowground tree biomass pools.
		CH_4	Included	Non-CO_2 gases emitted from woody biomass burning are included in the project in case if fire occurs.
		N_2O	Included	
	Combustion of Fossil Fuels	CO_2	Excluded	IBAP currently manages the two parks and will continue to do so in the project scenario. Therefore, fossil fuel consumption is expected to be very similar in the baseline and project scenario.
		CH_4	Excluded	Potential emissions are negligibly small
		N_2O	Excluded	Potential emissions are negligibly small
	Use of Fertilizer	CO_2	Excluded	Conservatively omitted from both the baseline and project scenarios.
		CH_4	Excluded	Conservatively omitted from both the baseline and project scenarios.
		N_2O	Excluded	In Guinea-Bissau the traditional agricultural method does not utilize fertilizers. In the project scenario, fertilization application is also not expected.

e. Sources of leakage

Leakage is expected to be minor as discussed in the Leakage Management section. Furthermore, the Government never contemplated ring fencing the project area and removing populations, thus there will be no direct dislocation of people due to the project activity. The evaluation of the potential displacement of activities from the Project Area to the Leakage Belt follows VMD0010 (LK-ASU).

Resident population density is low inside the project areas. The 2007 census[18] is the most recent socio-economic study in the Project Area. Cacheu National Park has 28,052 inhabitants with a population density of 38 hab/km^2 and Cantanhez National Park has 23,992 inhabitants with a population density of 21 hab/km^2. A PRA also demonstrate that immigrants comprises 9.3% of the population. The FIAL[19] works with this population to promote conservation goals

[18] INEP/INEC: Recenseamento, Estudo Socio-económico e Ambiental das Áreas Protegidas – 2007
[19] Instituto da Biodiversidade e das Área Protegidas (IBAP). 2007. Estratégia Nacional para as Áreas Protegidas e a Conservação da Biodiversidade na Guiné- Bissau 2007 – 2011. Bissau, 78

by: (i) financing small-scale investments in basic socio-economic infrastructure and productive activities, and (ii) linking the planning processes and approved micro-project to the REDD Project objectives, using a classic community-driven demand methodology. Approval of micro-projects is explicitly linked to the Cacheu Park and Cantanhez Park objectives by the Park Management Committee. FIAL typically provides matching grants of up to US$10,000 per community in support of specific, community-based micro-projects that can be linked to conservation objectives. FIAL activities are concentrated on communities located in or around protected areas.

Park Management Committees (with 50% community participation) and the Participatory Park Patrols have established a collaborative ethic supporting sustainable development in each Park; and organized communities residing in and around the Protected Areas are eligible for access to FIAL. The socio-economic survey and census done as part of FIAL preparation established an eligible target population of 70,000 people already within the PAs and the 2 km outside radius (buffer zone) of each PA to remove the incentive for people to move into the PAs to benefit from FIAL.

Source		Gas	Included?	Justification/Explanation
Leakage	Local Deforestation Agents	CO_2	Included	FIAL independent evaluation has shown a success rate above 80% of the Community Micro-Project. Leakage considers a 20% failure rate of FIAL
		CH_4	Excluded	Potential emissions are negligibly small
		N_2O	Excluded	
	Immigrant Deforestation Agents	CO_2	Included	According to the PRA done in the project area 9.3% of the population is immigrant
		CH_4	Excluded	Potential emissions are negligibly small
		N_2O	Excluded	

2.4 Baseline Scenario

The baseline scenario describes the most plausible scenario in the absence of the Project Activity. Land use in Guinea-Bissau is characterized by traditional agricultural practices performed by the local communities that have customary land use rights. Slash-and-burn is the common agricultural practice with consequent loss in forest cover[20]. According to Temudo (1998), after the land is cleared the agricultural activities typically comprise 8-year shifting rotation: 2-year cropland and 6-year fallow.

In an attempt to promote the conservation and sustainable use of natural resources, including the reduction of deforestation, the Government of Guinea-Bissau launched a concerted effort to conserve the country´s biodiversity in the late 1990s and early 2000s. These efforts resulted in the creation of IBAP in 2004 and the establishment of a national network comprised

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[20] National deforestation rate between 2002 and 2010 was 37,782 ha per year

of five national and one community protected areas. IBAP has the mandate of issuing policies and rules related to biodiversity conservation and the management of the network of national protected areas.

To date the Government, and more specifically, IBAP's efforts have been exclusively financed by external sources, namely international donor and NGO projects. Government funding for IBAP and the protected areas has not been forthcoming due to the urgency of competing development priorities (health, education, basic infrastructure, among others) and chronic budget shortages[21]. This heavy dependence on external ad hoc, project-based financing puts the sustainability of the achievements at risk, and finding a way to secure regular, stable sources of financing able to sustain the conservation activities over the long term is one of the key challenges facing the country.

Hence, while the CBMP has been successful in establishing IBAP, building the management capacity for the protected areas network in Guinea-Bissau, and securing community involvement and commitment to the conservation goals through the FIAL, unless funding is secured over the long term, there is a serious risk that the achievements to date will be eroded. Although some limited transitional financing has been secured through 2013 and 2015 through the follow-on GEF and IDA financed projects, respectively, this financing in turn will end, which once again confirms the importance of securing sustainable long term financing for these activities. Even with this transitional support, while enabling IBAP to maintain a minimum presence on the ground, the scope of management activities is significantly constrained. Furthermore, funds are currently not available to support implementation of any new FIAL initiatives.

The Government is requesting additional financing from the GEF to help capitalize the Foundation, but the available envelope for Guinea-Bissau is small (maximum of US$ 4.6 million under the current Resource Allocation Framework - RAF 5) and would still leave a financing gap[22]. Additional World Bank IDA financing is unlikely, given the high priorities of the country on infrastructure and budget support and the limited three year IDA envelope available (approximately US$ 25 million). Similarly, funding from other donors is likely to remain low, particularly in the context of the ongoing global economic crisis.

Given this context, the Government of Guinea-Bissau is likely not to be able to finance the on-going management of Cacheu and Cantanhez. Without financing, IBAP and FIAL will be unable to sustain the on-going dialog with the community nor be able to provide the technical and financial assistance necessary to enable the communities to identify and implement alternatives that reduce pressure over the forest. Under these circumstances, the most

[21] Around the globe, funding for PAs depends on budget allocation of central governments, however, according to IBAP's Annual Activity Report- 2011: "in Guinea-Bissau the environmental management sector does not have the privilege of public funding, because other sectors like health, education and infrastructure are priority and have immediate urgency".

[22] The GEF Biodiversity Conservation Trust Fund project, seeks to secure $3-5m as initial seed capital to the FBG, with a view in the first instance to financing the core recurrent costs of two marine protected areas: Joao Vieira e Poilao National Park and Orango National Park.

plausible scenario in the absence of the project activity is the dominance of traditional land use practices with a consequent acceleration in deforestation rates.

2.5 Additionality

As per VT0001 (Tool for Demonstration and Assessment of Additionality in VCS AFOLU Project Activities), version 3.0, project proponent(s) shall apply the following four steps:

STEP 1. Identification of alternative land use scenarios to the AFOLU project activity;

This step serves to identify alternative land use scenarios to the proposed VCS REDD project activity that could be the baseline scenario, through the following sub-steps:

Sub-step 1a. Identify credible alternative land use scenarios to the proposed VCS REDD project activity:

Two realistic and credible land-use scenarios are identified and could occur on the land within the project boundary in the absence of the REDD project activity under the VCS. The scenarios are feasible based on relevant national policies and circumstances, such as historical land uses, practices and economic trends. The alternative land use scenarios are:

Alternative I.

Under this scenario, funding for IBAP would be drastically reduced and deforestation rates would accelerate. Observed historical deforestation rates would continue similar to pre-project trends. Currently, FIAL already lacks the resources to support micro-projects in Cacheu and Cantanhez.

Alternative II.

Under this scenario, the Government of Guinea Bissau has both successfully secured sufficient financial means and has the political will to dedicate these resources to sustaining and supporting the conservation efforts in Cacheu Mangrove Forest National Park and in Cantanhez Forest National Park over the long term.

Sub-step 1b. Consistency of credible land use scenarios with enforced mandatory applicable laws and regulations.

All land use scenarios are compliant with mandatory applicable laws and regulations. Customary land use right are respected; therefore, traditional land use practices would continue to be performed by the population living in Cantanhez and Cacheu National Parks.

Sub-step 1c. Selection of the baseline scenario

The most plausible baseline scenario is Alternative Scenario I as defined in Step 3 (Barrier Analysis).

STEP 2. Investment Analysis to determine that the proposed project activity is not the most economically or financially attractive of the identified land use scenarios

Not Applicable.

STEP 3. Barriers Analysis

Sub-step 3a. Identify barriers that would prevent the implementation of the type of proposed project activity

This step will demonstrate that Alternative II is neither a credible nor a realistic scenario due to three main barriers:

A Financial Barrier exists because IBAP is not able to secure the necessary long-term financing commitments. The government has historically suffered from chronic public budget shortages and donor funding is both unpredictable and of limited duration.

An Institutional Barrier exists due to the history of political and institutional instability affecting the country. Tensions between the civilian government and the military lead to regular changes in government and ministers, undermining the implementation of national policies and strategies.

The proposed REDD project is the First of Its Kind in the country.

Consequently, the most likely scenario in the absence of the proposed REDD project is Alternative I, namely that deforestation rates would accelerate. The barriers are further discussed and substantiated below.

I. Financial Barrier:

Guinea-Bissau, with a population of 1.6 million, is one of the world‘s poorest countries. The country has ranked invariably in the bottom rung on the last decade‘s annual UNDP Human Development Indices, being the 164th out of 169 countries in the 2010 report for example. Income per capita in 2010 was estimated at about US$500. Chronic poverty is deep and entrenched, with an estimated 70 percent of the population living under the $2 dollar-a-day poverty line in 2010, a worsening since the 2002 estimate of 65 percent. Economic growth in the decade following the 1998-99 internal conflict has barely exceeded population growth. Low growth has also translated into low state revenues. The Government cannot generate sufficient revenues to finance the country’s expenses and is characterized by a frequent inability to pay public suppliers and employees, and a general inability to fund development spending. Guinea-Bissau’s developmental challenges are considerable and the competition between sectors for scarce public and donor resources is high. Despite Highly Indebted Poor Country (HIPC) debt relief in 2010, as demonstrated in Table 1 below, the country continues to struggle with significant budget deficits and remains entirely dependent on donors.

Table 2. Guinea Bissau Revenues and Expenditures 2009 - 2011

	Δ GDP	Revenues (million FCFA)	Expenses (million FCFA)	Budget Deficit (million FCFA)
2009	2,9%	29,900.00	146,083.00	-116,183.00
2010	3,0%	44,994.00	121,114.00	-76,120.00
2011	5,3%	47,691.00	101,998.00	-54,307.00
2012	4,5%	61,783.00	116,063.00	-54,280.00

Source: Orçamento Geral do Estado, 2009, 2010, 2011 and 2012.

In this context, the Government has not been able to finance IBAP from the national budget and, in the face of very real and urgent competing development demands across all sectors, including but not limited to health, education and infrastructure, it is unlikely that this situation will change in the foreseeable future[23].

The absence of public financing means that management of GB's protected areas has and will continue to depend exclusively on external financing sources, more specifically, projects financed by international donors and NGOs. While, over the past decade, project-based financing has enabled the country to establish the legal and institutional framework and develop capacity to manage these valuable resources, this type of financing is not well suited to ensuring the ongoing management of the protected areas over time. Long term protected area management is a continual process, requiring steady and predictable financing streams able to sustain the core management activities (park staff, surveillance, stakeholder dialogue, monitoring, etc.) consistently over time. In contrast, as exemplified in Guinea Bissau, project-based donor financing is unpredictable and, even when secured, is typically characterized by: (i) short time frames (generally not more than a 4-5 year commitment); (ii) a preference to finance investment costs (equipment, consultancies, studies, etc.) over recurrent operating expenditures (staff, fuel, maintenance, etc.); and (iii) a focus on current donor financing priorities, which may not include or be well aligned with the country's protected area management concerns, thus leaving portions of their program needs unfunded. Furthermore, the constant need for fund raising, as well as the time required to meet the diverse donor reporting requirements, distracts IBAP's staff from focusing on their real mandate, which is to implement the protected areas management program of activities. The issues highlighted above clearly impact IBAP's operations, forcing IBAP to negotiate emergency funding with donors on an annual basis to cover its core operational financing gap: To illustrate this situation, in 2012, the salary gap alone was € 90,000, representing 42 percent of its salaries. In addition, the global financial crisis has negatively affected donor aid budgets. This, together with the political and economic uncertainties facing the country, means that neither the government nor international donors can provide the necessary financial stability proposed under Alternative II to ensure the management of Protected Areas over the long term.

[23] According to IBAP (2011) "in Guinea-Bissau the environmental management sector does not have the privilege of public funding, because other sectors like health, education and infrastructure are priority and have immediate urgency".

II. Institutional Barriers

Guinea-Bissau is a fragile state which, since the internal conflict of 1998-1999, has been characterized by political instability, often marked by the intrusion of the military or paramilitary on the political scene. Between 2004 and 2009, the average term of the successive governments did not exceed 6 months, and although the government was relatively stable between 2009 and early 2012, the April 2012 coup indicates that the country still has a long path to achieve a reasonable governance level. This situation has undermined law and order and weakened successive government's ability to provide essential public services and infrastructure and to run a broadly stable macroeconomic course. This instability has also undermined already weak institutions, impeding the consistent and persistent implementation of medium term strategies in virtually all areas of public policy, and contributed to high turnover in senior positions and to the exodus of qualified public personnel. An evaluation of The World Bank Governance Index[24] (WGI) for the last five years highlights the country's weak institutional context in Guinea-Bissau. The average grade between the six indicators that composes the index is -1.02 in the period 2007 and 2011.

Table 3. WGI of Guinea-Bissau (GNB) between 2007 - 2011

	GNB					
Indicator	2007	2008	2009	2010	2011	Average
Voice and Accountability	-0.77	-0.77	-0.80	-0.88	-0.97	-0.84
Political Stability	-0.45	-0.69	-0.65	-0.66	-0.70	-0.63
Government Effectiveness	-1.12	-1.06	-1.04	-1.04	-1.04	-1.06
Regulatory Quality	-1.08	-1.2	-1.19	-1.14	-1.12	-1.15
Rule of Law	-1.34	-1.42	-1.36	-1.35	-1.31	-1.36
Control of Corruption	-1.14	-1.09	-1.11	-1.07	-1.06	-1.09

Given this, and the historical roots underpinning this situation, as well as the inter dependence of economic and political developments, it is unrealistic to expect that the country will in the near future have a sufficiently stable political environment and strong enough institutions to achieve Alternative II.

III. First of Its Kind Barrier

Finally, the third barrier relates to the common practice for financing Protected Areas in Guinea-Bissau. This REDD Project is the first of its kind in the country and represents a breakthrough. This can be demonstrated through a research in the VCS Project Database (www.vcsprojectdatabase.org). Sectoral Scope 14 (AFOLU) currently holds 42 projects. None is hosted by Guinea-Bissau.

Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of the alternative land use scenarios

[24] Scores range from -2.5 to 2.5

The remaining alternative scenario is Scenario I. None of the above listed barriers prevent the occurrence of the Alternative Scenario I. In fact, the listed barriers corroborate and strengthen the feasibility of Scenario I as the most likely baseline scenario in the absence of the proposed REDD Project Activity.

STEP 4. Common Practice Analysis.

To date, the network of protected areas of Guinea Bissau includes five National Parks that are legally established. All of them suffer from the same weak institutional and financial capacity hindering the proper management of the parks areas. The objective of the proposed REDD project activity is to provide intensive monitoring and effective enforcement into the project area seeking the full conservation of the forests Cacheu and Cantanhez hold and to establish an benefit sharing mechanism to demonstrate tangible returns to the communities due to forest conservation. Thus, although the network of protected areas exist none of the parks can be considered similar to the proposed project activity as no other area can provide the same level of monitoring and enforcement to pursue full conservation of forests. The project can be considered unique as no other similar activities exist in Guinea-Bissau.

The principle aspects that differentiate the project from other previous and on-going conservation initiatives in the country's National Parks are threefold:

(1) the source and sustainability of financing - it is the first REDD initiative in Guinea-Bissau. To date, all conservation projects have been forced to rely on short-term donor grant financing (1-5 yrs), which inhibits the planning and attainment of long term park conservation objectives. This project will, for the first time, tap into a long-term market based initiative thus allowing for long term planning and execution. Furthermore, the project design linking the REDD initiative with the BioGuine Foundation will allow a portion of the carbon revenues accrued during the 20 year crediting period to be converted into a sustainable flow of financing able to support forest conservation in the project areas in perpetuity;

(2) currently the effectiveness of park management activities is monitored based on proxy data, the project will produce for the first time actual field data for tracking and evaluating the impact of forest management activities. This will greatly strengthen the on the ground capacity to conserve these resources; and, additionally,

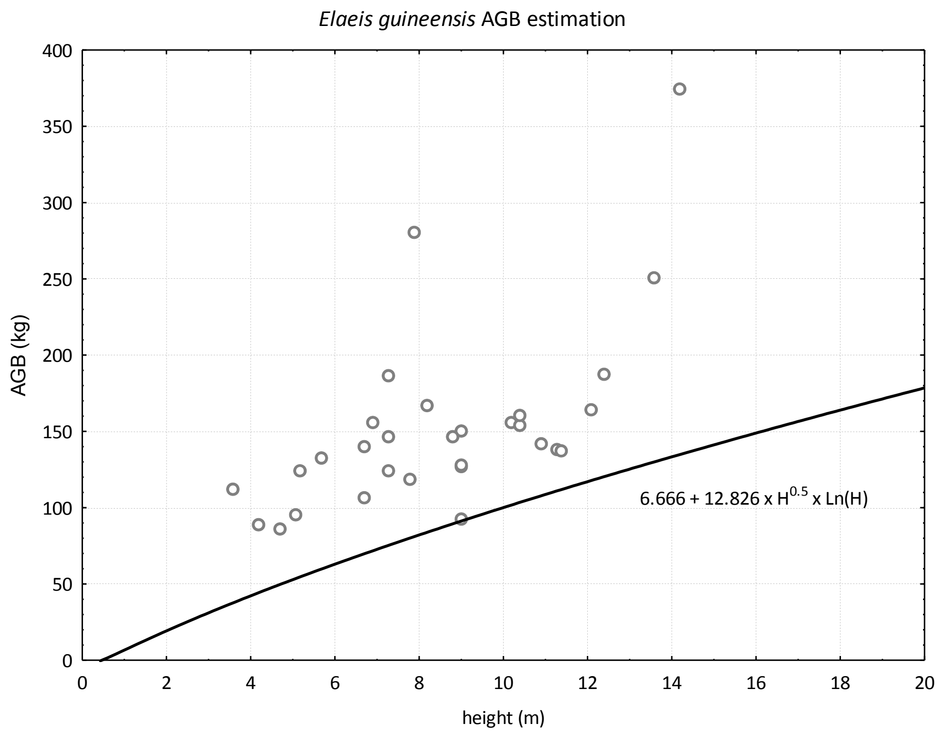
(3) to date evaluation of community micro scale projects has been done on a case-by-case basis, project ecosystem level monitoring will enable a broader park level impact assessment to be executed. The predictability of long term financing together with actual field monitoring of ecosystem health trends will thus transform the ability to manage and preserve this forest resources.

To corroborate these distinct differences that makes the REDD project activity not a common practice in the country, the Secretary of State of Environment and Tourism, Sr. Agostinho da Costa, declared that the "Community Based Avoided Deforestation Project in Guinea Bissau will promote, for the first time, systematic forest monitoring activities, continuous dialog and support to local communities and provide technical assistance allowing the development of alternative subsistence activities and income generation through sustainable agricultural production" (GAB_SEC_EST.pdf). Further, the secretary reinforces that the project will allow that financial barriers be overcome, supporting the protected areas and the communities in Cacheu and Cantanhez in the long run. Similarly, the Union Internationale pour la Conservation de la Nature (IUCN) provided documental evidence (IUCN_STATEMENT.pdf) to support the differences between the project activity and other protected areas in the country. The NGO is present in Guinea-Bissau since 1988 and is fully aware of the country´s challenges and efforts in the conservation of its terrestrial and coastal forests. According to IUCN "the activities that are being proposed go beyond the current efforts undertaken by IBAP and its partners and cannot be considered common practice in the country".

2.6 Methodology Deviations

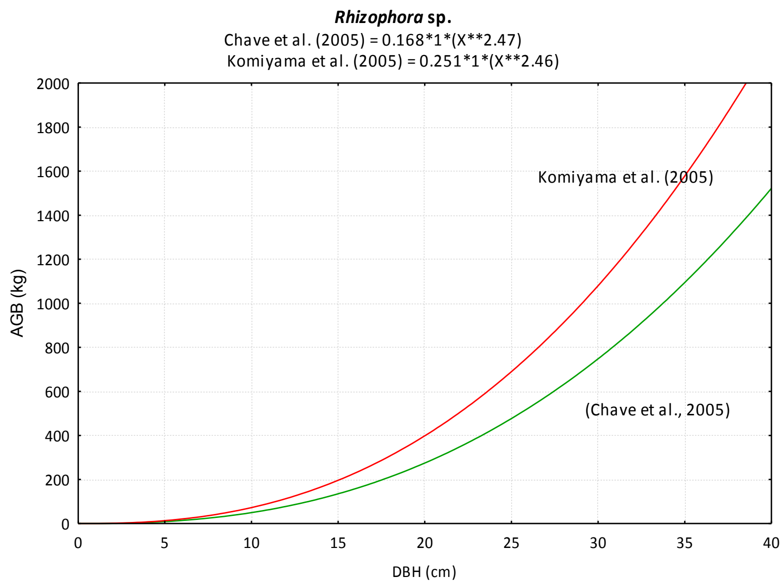
Six deviations had been approved in the course of the project validation. All of them relates only to the criteria and procedures for monitoring and measurement, and does not relate to any other part of the methodology, and will not negatively impact the conservativeness of the quantification of GHG emissions reductions or removals.

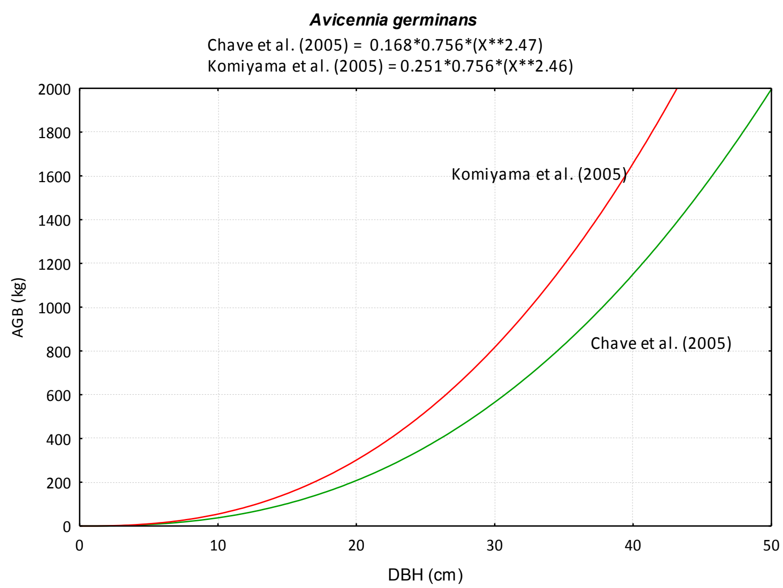
1. Use of Delaney et al. (1999) equation to calculate palm biomass: after extensive literature research (8 equations) it was concluded that no palm equation specific to Guinea-Bissau or to West Africa, or even species-specific for mature stands of naturally grown Elaeis guineenses is available in the literature. All equations miss one of the methodology´s applicability conditions: either not based on at least 30 sampled individuals, or not having $r^2 > 0.8$. The project requested a deviation to apply an equation for palms with similar physiognomy listed by the IPCC (2003) in the GPG-LULUCF that comply with the methodological requirements. The deviation delivers conservative results. The graph below demonstrates the conservativeness of the Delaney et al. (1999) equation in comparison to the limited measurement approach.



Further, the deviation was approved once it relates only to the criteria and procedures for monitoring and measurement, in special the validation of the allometric equation to estimate carbon stocks in aboveground live biomass for Palms, not affecting other parts of the methodology. This can be demonstrated referencing back to the methodology modules and where the resulting parameter ($C_{AB\_tree,\ Palm}$) is applied. The resulting data (Aboveground carbon stock in Palm trees) is used exclusively for two aspects, monitoring and measurement. Measurement is the process for obtaining information about data that feeds in the quantification of GHG emission reduction. Therefore, the parameter provides the carbon stocks of a tree type (Palm trees) according to module CP-AB. Monitoring consists of continuous or periodic assessment of GHG emissions reductions or removals. In the project case, the parameter is used to calculate carbon stock changes in the leakage belt and the project area and used to assess GHG emissions reductions or removals on modules BL-UP, LK-ASU and M-MON. The file "Corrective Action Plan Palms – Finding 2012.30 – revised20130625.docx" detail the equation applicability, its testing and the conservative results.

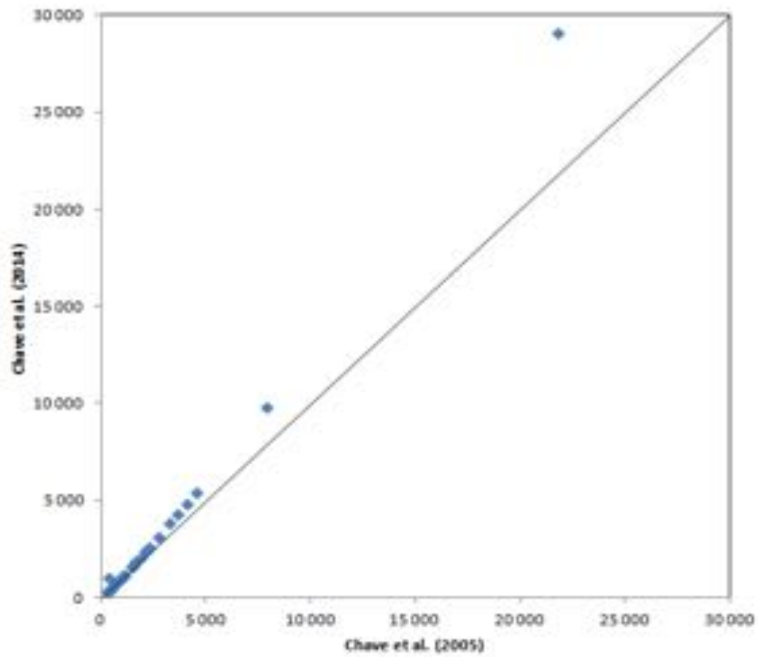
2. Validation of the allometric equation for Mangrove after the validation but prior to the verification of the project: In light of the fact that the Chave equation is anticipated to be conservative, and will undervalue the actual AGB for the mangroves within the project area, a methodological deviation was approved such that the validation of the mangrove equation be completed after project validation, but prior to project verification. After researching the available literature the Chave equation is anticipated to be conservative for both mangrove species in Guinea-Bissau in comparison to the other equation that could be applied (Komiyama et al. 2005) as demonstrated in the graphs.





Additional fieldwork is required for validation of Chave et al. (2005) equation following the “Limited Measurement” approach. 16 individuals of Rhizophora sp. and 14 of Avicennia sp. will be measured to guarantee that species representation is in proportion to relative basal area encountered in the fieldwork. The detailed data collection procedure was presented and validated, the file “Corrective Action Plan Mangrove – Finding 2012.28-29 – revised20130625.docx” detail procedures and demonstrate that Chave et al. (2005) is conservative and can be use for the ex ante emission reduction quantification and be later validated prior to verification. The requested deviation only relates to the criteria and procedures for monitoring and measurement, in specific the validation of the allometric equation to estimate carbon stocks in aboveground live biomass for Mangroves, and does not relate to any other part o the methodology. This can be demonstrated referencing back to the methodology modules and where the resulting parameter ($C_{AB\_tree,\ Mangrove}$) is applied. The resulting data (Aboveground carbon stock in Mangrove trees) is used exclusively for two aspects, monitoring and measurement. Measurement is the process for obtaining information about data that feeds in the quantification of GHG emission reduction. Therefore, the parameter provides the carbon stocks of a tree type (Mangrove trees) according to module CP-AB. Monitoring consists of continuous or periodic assessment of GHG emissions reductions or removals. In the project case, the parameter is used to calculate carbon stock changes in the leakage belt and the project area and used to assess GHG emissions reductions or removals on modules BL-UP, LK-ASU and M-MON.

3. Validation of the allometric equation for terrestrial forest after the validation but prior to the verification of the project: the project requested a deviation since sampling conducted during the fieldwork was not sufficient to validate the allometric equation for terrestrial forest. Therefore, validation of the allometric equation for terrestrial forest will be carried after validation but prior to the verification of the project. The approved deviation relates only to the criteria and procedures for monitoring or measurement in specific the validation of the allometric equation to estimate carbon stocks in aboveground live biomass for terrestrial forest, and does not relate to any other part o the methodology. This can be demonstrated referencing back to the methodology modules and where the resulting parameter ($C_{AB\_tree,\ Terrestrial\_Forest}$) is applied. The resulting data (Aboveground carbon stock in terrestrial forests) is used exclusively for two aspects, monitoring and measurement. Measurement is the process for obtaining information about data that feeds in the quantification of GHG emission reduction. Therefore, the parameter provides the carbon stocks of a tree type (terrestrial forests) according to module CP-AB. Monitoring consists of continuous or periodic assessment of GHG emissions reductions or removals. In the project case, the parameter is used to calculate carbon stock changes in the leakage belt and the project area and used to assess GHG emissions reductions or removals on modules BL-UP, LK-ASU and M-MON. Additional fieldwork will be required to validate Chave et al. (2005) equation, as almost all trees in the dataset fork to low in the trunk, and thus are likely to produce over conservative estimates. The same Limited Measurements approach will be followed when collecting new data but the measurements will be made until a diameter of 10 cm instead of only until the first trunk fork. With this adjustment it will be possible to work on a dataset that better represents the forest trees in the project area and validate the use of the Chave et al. (2005) allometric equation. As demonstrated in the file "Finding 2012.27 – Validation of Chave allometric equation v3_20140912.docx" the equation can be considered conservative. Using the 40 trees sampled, two applicable equations from Chave et al. (2005) for dry forest and the single equation presented at Chave et al. (2014) were compared so the most conservative one could be applied for ex-ante estimation thus not negatively impacting the conservativeness of quantification of GHG. Results are presented below.

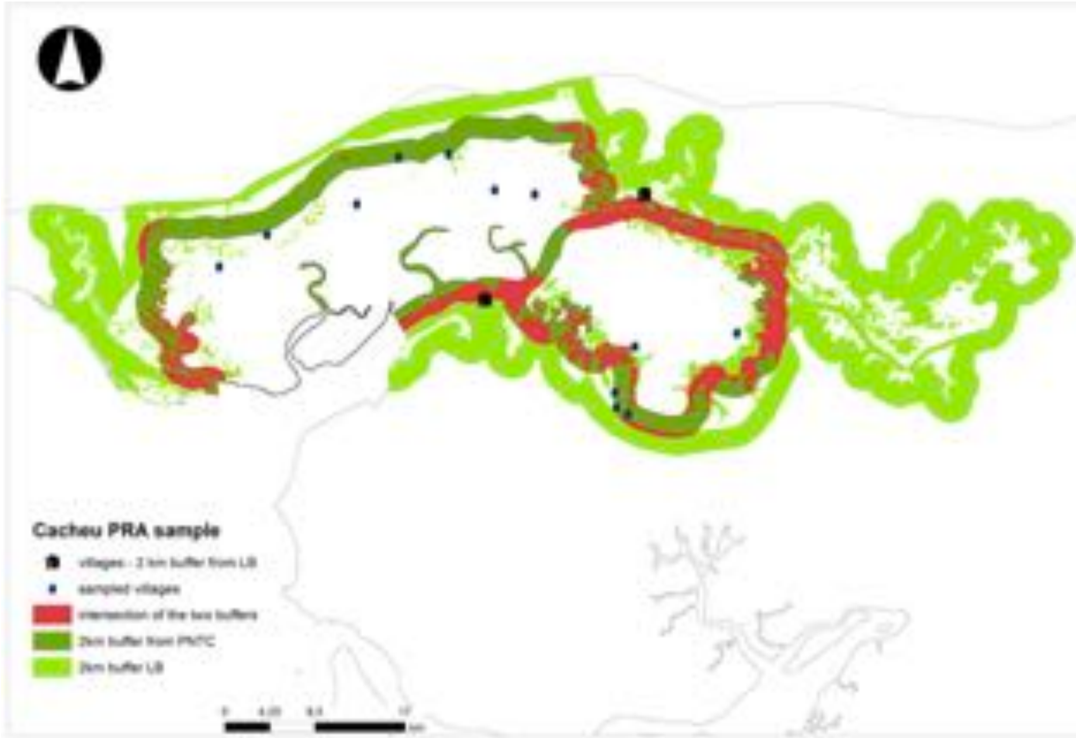


The use of Chave et al. (2005) is more conservative and, consequently, used for ex ante estimation.

4. Establishment of two distinct RRDs: given the characteristics of each Protected Area (PA) the project decided to establish two distinct RRDs to better reflect baseline emissions on each PA. Similarly, two distinct Leakage Belt had been establish to reflect the local reality of each PA. The project understand that such approach results in more accurate estimation of baseline emissions by ensuring that the estimated baseline for each of the Cacheu and Cantanhez National Parks are fully reflective of historical deforestation in the immediate vicinity of said PA. A detailed baseline study prepared by Winrock International and IICT presents step-by-step procedures for the determination of each RRD (WB_revisionupdate_Final_Report_v6.pdf). The applied approach constitutes a deviation only to the criteria and procedures for monitoring or measurement of the Leakage Belt, one for Cantanhez and one for Cacheu, and the RRD, one for Cantanhez and one for Cacheu, and does not relate to any other part of the methodology. More specifically, the deviation impacts the correspondent areas (A_{RRD} and A_{LK} in ha) of the RRD and the Leakage Belt. The areas of the RDD and the Leakage Belt are used as a data that feeds in the quantification of GHG emissions for the baseline scenario (BL-UP module) both in the RRD and the Leakage Belt, therefore as criteria for measurement. The areas are also used for the subsequente continuous or periodic assessment of GHG emission reduction according to module M-MON, therefore as criteria for monitoring net carbon stock changes. As detailed on the PD, the individual baseline emissions and leakage emissions are simply summed to present more accurante aggregate project values.

5. Ex-ante Leakage Calculation: strict application of Equation 6 of LK-ASU would result in negative value in the outcome and, thus, erroneous quantification of GHG emission reductions. Thus, the project had reversed the order of the subtraction of the changes in the baseline scenario from the changes in carbon stocks in the project scenario for ex-ante quantification purposes, not negatively impacting the conservativeness of the quantification of GHG emissions reductions. If the reversion in the order of the subtraction is not performed, leakage emissions are negative and, consequently, emission reduction estimated *ex-ante* is higher. The conservativeness of the applied approach can be demonstrated since the current application of the deviation result in a lower emission reduction estimated *ex*-ante in comparison to the emission reduction estimated with the strict application of Equation 6 of LK-ASU. This deviation only relates to criteria and procedures for measurement of ex ante leakage emissions and does not relate to any other part of the methodology. Equation 6 is used in the process of obtaining information about data that feeds in the quantification of GHG emission reduction, in this case the measurement of unplanned deforestation displaced from the project area to outside the Leakage Belt (Step 4). The detailed quantification of ex-ante Leakage Emissions is presented in the workbook GB-REDD_ER_v5.xlsx.

6. PRA sample design: a Participatory Rural Appraisal (PRA) was conducted to evaluate the project area degradation potential and to quantify the immigration population ($PROP_{IMM}$) living within the Project Area. Degradation was found to be irrelevant since fuelwood collection is mainly undertaken from deadwood, and therefore, degradation emissions are considered zero in the ex-ante emissions quantification. The immigration population was used to calculated leakage emissions inside and outside the leakage belt. A deviation was requested because the PRA sample design is not fully compliant with methodology requirements. The deviation only related to the criteria and procedures for measurement and does not related to any other part of the methodology. More specifically, sample design was undertaken considering an area of 2km outside the Project Area boundary while methodology requires that sampling take place in an area of 2 km from the Leakage Belt. The deviation does not negatively impact the conservativeness of the quantification of the GHG emissions reductions or removals as demonstrated on the file 2012.46_PRA_DEVIATON.docx. The sample design had to be adjusted given the lack of reliable information. The government, or any other public agency, does not have information on villages locations (i.e coordinates) so a local census undertaken under the CBPM project was used. For CBMP, conservation and poverty alleviation measures are undertaken inside the project area and in a 2 km belt. Therefore, the project is applying the most reliable information available. Spacial evaluation identified that 36.5% of the villages sample fully comply with the requirement of 2 km from the Leakage Belt. The map below shows the areas of the 2 km from the project area, 2 km from the leaka belt and the intersection of the two areas.



Criteria for the selection of the reference region (RRD) and leakage belt (LK): the BL-UP module establishes the criteria for the selection of the RRD and LK. For the RRD, section 1.1.1.1 lists 6 aspects to be considered when defining the RRD boundary. The module also allows for a relaxation of ±20% on some of these criteria. In the same way, for the LK section 1.1.3 lists 7 aspects to be considered when defining the LK boundary, also allowing for a relaxation of ±20% on some of these criteria. A deviation was approved because non-material variations, between 1% and 3%, were identified when the final boundaries of the RRD and LK were defined. The deviation does not negatively impact the conservativeness of the quantification of the GHG emissions reductions or removals because conservative assumptions, values and procedures were used to ensure that net GHG emission reductions are not overestimated. The file Justification_PA_RRD_LK_Cacheu_Cantanhez.xlsx evidences why the deviation is conservative. In total, 3 criteria are not compliant with BL-UP: (1) the proportion of the terrestrial forests class in the RRD, in comparison to the PA, is 3% above the upper limit. This is so because Guinea-Bissau is a small country and there is no sufficient forest cover to comply with the methodology. (2) One soil class in the RRD was not identified in the PA resulting in 1% of the soil classes in the RRD not identified in the PA and (3) the ferralsols in the LK is 1% above the upper limit. It is not expected that imaterial differences in soil proportions will affect the quantification of GHG emission reductions. All other criteria are compliant with the module. Further, the applied approach constitutes a deviation only to the criteria and procedures for monitoring or measurement of the Leakage Belt and the RRD, and does not relate to any other part of the methodology. More specifically, the deviation impacts the correspondent areas (A_{RRD} and A_{LK} in ha) of the RRD and the Leakage Belt. The areas of the RDD and the Leakage Belt are used as a data that feeds in the quantification of GHG emissions for the baseline scenario (BL-UP module) both in the RRD and the Leakage Belt, therefore as criteria for measurement. The areas are also used for the subsequente continuous or periodic assessment of GHG emission reduction according to module M-MON, therefore as criteria for monitoring net carbon stock changes.

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

Following BL-UP, the boundaries for the project were established and historical deforestation evaluated during the historical reference period within the RRD and the Leakage Belt as demonstrated in section 2.3 of this VCS PD. The Simple historic Baseline rate approach was followed for projecting the rate of deforestation.

3.1.1 Collection of Appropriate Data Sources

Under the CARBOVEG-GB project the Tropical Research Institute (IICT) produced Landsat image mosaics for the entire country for the years 2002 and 2007. These mosaics were used along with new images from 2010. The original Landsat scenes, path/rows and acquisition dates of the images covering the relevant areas are shown in
Table 4 for 2002 and 2007 and in Table 5 for 2010.

Table 4. Landsat imagery from 2002 and 2007 used in CARBOVEG-GB

Satellite	Sensor	Resolution		Coverage	Acquisition date	Scene or point identifier	
		Spatial (m)	Spectral (µm)	(km^2)	(DD-MM-YYYY)	Path	Row
Landsat	TM	28.5	0.45-2.35	32,000	02-04-2002	205	51
Landsat	TM	28.5	0.45-2.35	32,000	07-02-2007	205	51
Landsat	ETM+	28.5	0.45-2.35	32,000	11-04-2002	204	51
Landsat	TM	28.5	0.45-2.35	32,000	28-02-2007	204	51
Landsat	TM	28.5	0.45-2.35	32,000	11-04-2002	204	52
Landsat	TM	28.5	0.45-2.35	32,000	28-02-2007	204	52
Landsat	TM	28.5	0.45-2.35	32,000	04-04-2002	203	52
Landsat	TM	28.5	0.45-2.35	32,000	09-03-2007	203	52

Table 5. Landsat imagery from 2010 (available at: http://glovis.usgs.gov/). Primary scenes and fill scenes for 2010.

Satellite	Sensor	Resolution		Coverage	Acquisition date	Scene or point identifier	
		Spatial (m)	Spectral (µm)	(km^2)	(DD-MM-YYYY)	Path	Row
Landsat	ETM+	30	0.45-2.35	32 000	02-01-2010	205	51
Landsat	ETM+	30	0.45-2.35	32 000	18-01-2010	205	51
Landsat	ETM+	30	0.45-2.35	32 000	19-02-2010	205	51

Landsat	ETM+	30	0.45-2.35	32 000	07-03-2010	205	51
Landsat	ETM+	30	0.45-2.35	32 000	23-03-2010	205	51
Landsat	ETM+	30	0.45-2.35	32 000	27-01-2010	204	51
Landsat	ETM+	30	0.45-2.35	32 000	12-02-2010	204	51
Landsat	ETM+	30	0.45-2.35	32 000	28-02-2010	204	51
Landsat	ETM+	30	0.45-2.35	32 000	16-03-2010	204	51
Landsat	ETM+	30	0.45-2.35	32 000	01-04-2010	204	51
Landsat	ETM+	30	0.45-2.35	32 000	27-01-2010	204	52
Landsat	ETM+	30	0.45-2.35	32 000	12-02-2010	204	52
Landsat	ETM+	30	0.45-2.35	32 000	28-02-2010	204	52
Landsat	ETM+	30	0.45-2.35	32 000	16-03-2010	204	52
Landsat	ETM+	30	0.45-2.35	32 000	01-04-2010	204	52
Landsat	ETM+	30	0.45-2.35	32 000	20-01-2010	203	52
Landsat	ETM+	30	0.45-2.35	32 000	09-03-2010	203	52

3.1.2 Mapping of Historical Land-Use and Land-Cover change

The pre-processed images listed above were used in a mapping operation that followed a three-step approach: preprocessing, classification, and validation. The preprocessing included geometric corrections, radiomatric calibration, and gap fill for the 2010 images. The gap fill methodology by Scaramuzza et al. (2004) was applied to the 2010 images affected by the malfunctioning of the Scan-line corrector mechanism and the relative radiometric calibration procedure by Phua et al. (2008) was applied prior to building the mosaic layers for the years analyzed. The need for this procedure explains the high number of images used to compose a complete mosaic for the dry season of 2010.

The forest class was divided into two sub-classes - terrestrial forest and mangrove - and used to produce maps for 2002, 2007, and 2010. A further subdivision of the "terrestrial forest" class was assessed (Closed-Forest, Open-Forest, and Savanna) to be consistent with the stratification presented by the country in it 2nd National Communication. However, as this subdivision of the "terrestrial forest" class failed to comply with the accuracy requirements, only the two sub-classes (terrestrial forest and mangrove) were used to assess the changes of forest areas, derive the deforested areas, and the deforestation rates. Deforestation Maps showing areas of deforestation with paired data were produced for the RRD for the time periods between each historic image, i.e. 2002-2007 and 2007-2010.

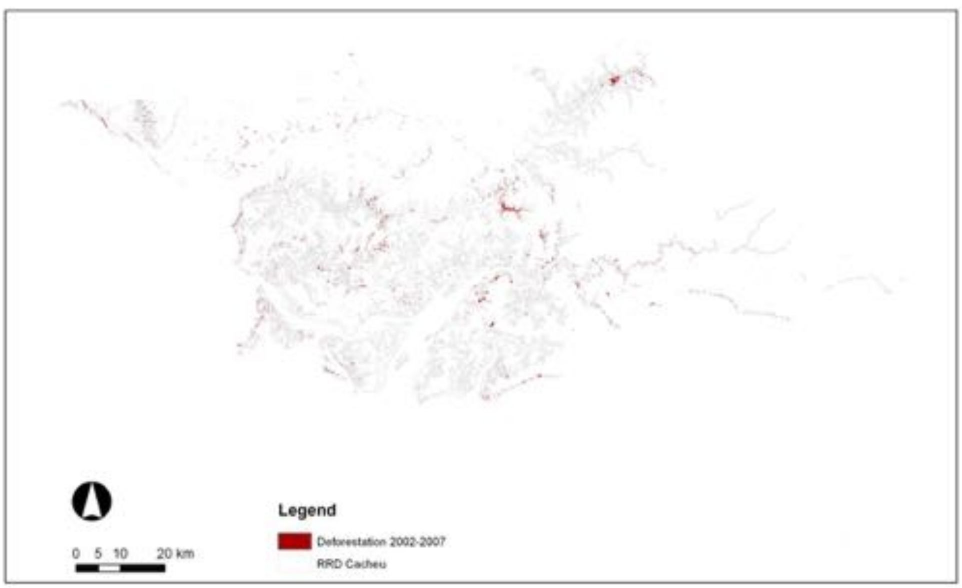


Figure 8. Deforestation Map for Cacheu RRD – 2002-2007

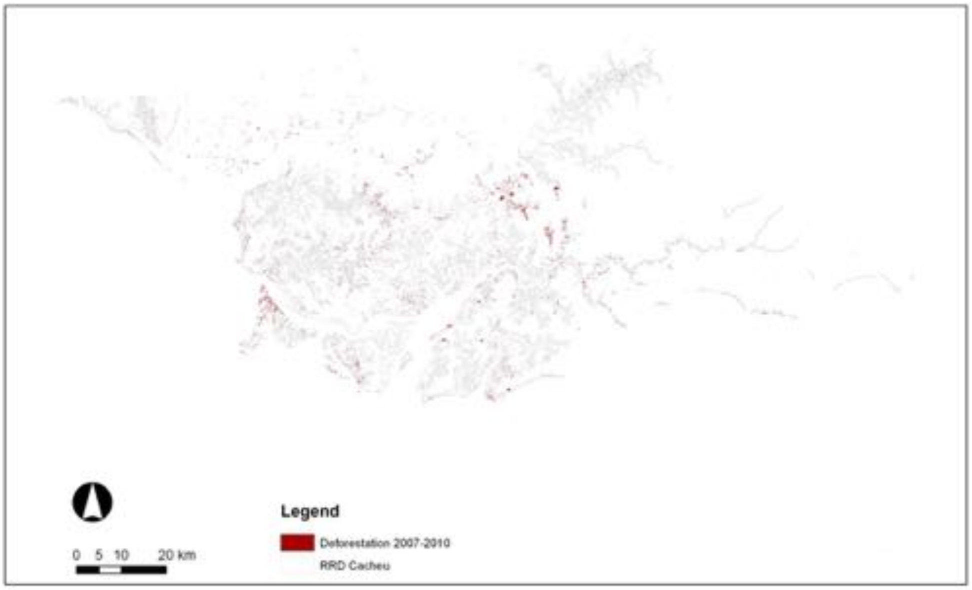


Figure 9. Deforestation Map for Cacheu RRD – 2007-2010

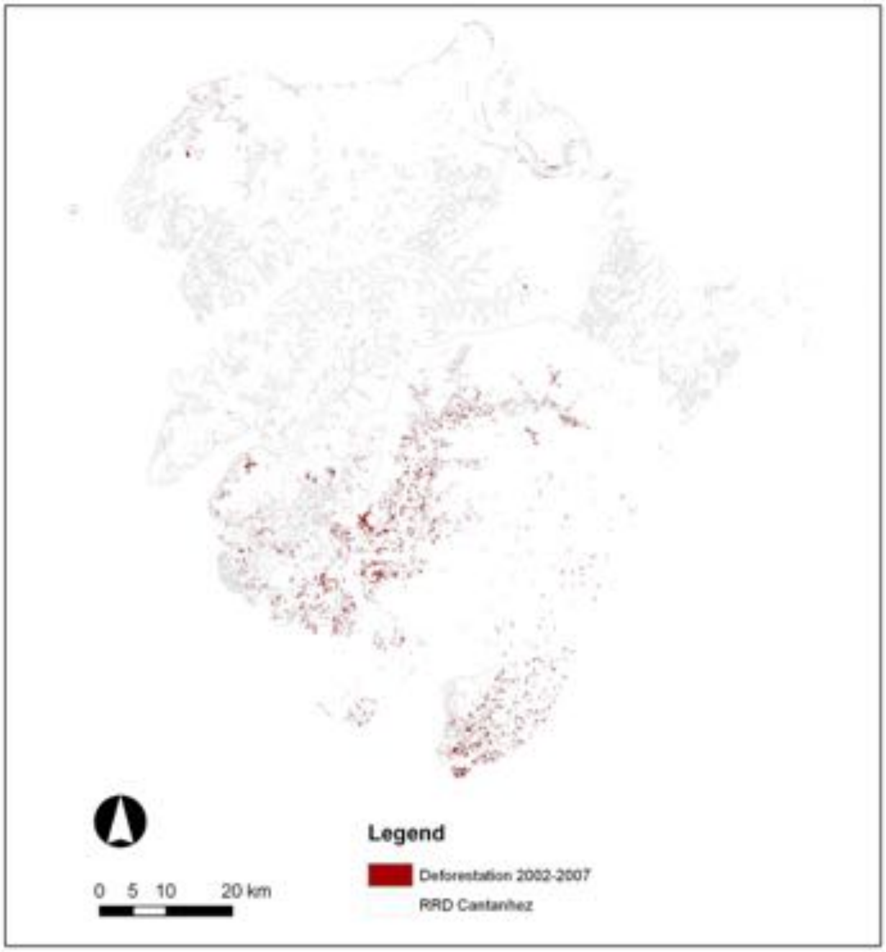


Figure 10. Deforestation Map for Cantanhez RRD – 2002-2007

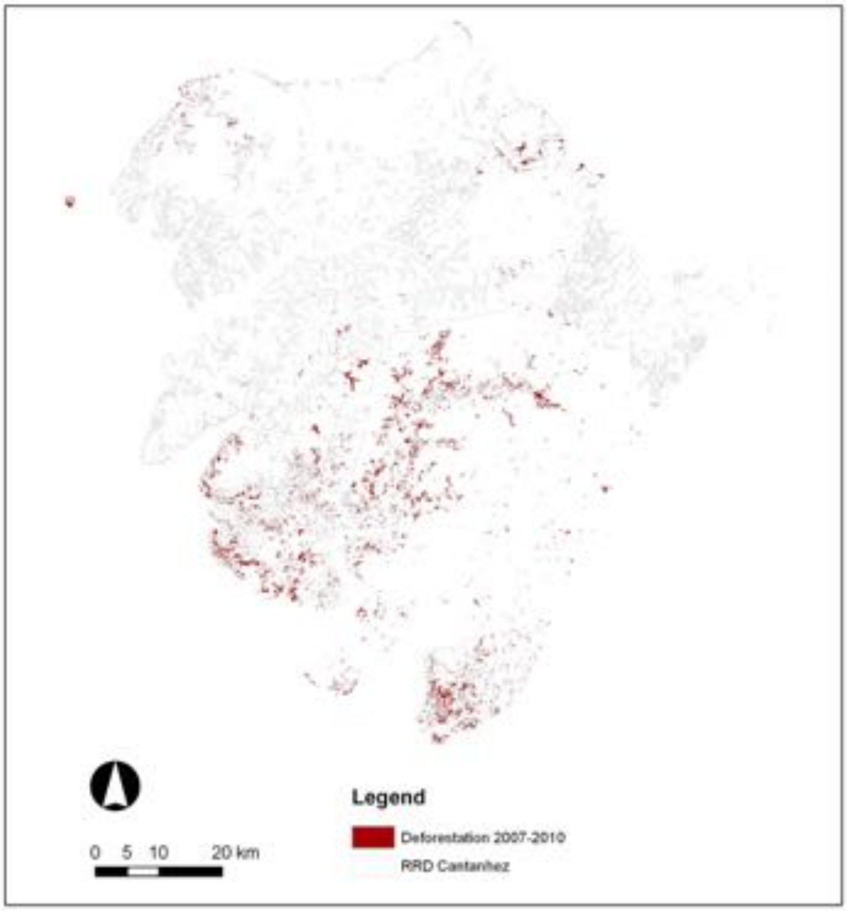


Figure 11. Deforestation Map for Cantanhez RRD – 2007-2010

To estimate the historical deforestation, a conservative approach was followed. Only areas that were permanently deforested were accounted as deforestation, i.e. where post-deforestation land use constitutes reforestation this area is not included in the deforestation estimates. Thus, any areas in the baseline where forest is converted to any other reforestation activity (e.g. cashew, natural regrowth) are not eligible, and were excluded from the baseline deforestation. Gross deforestation is defined as the loss in forest area over a given time period caused by conversion of forest to non-forested land (GOFC-GOLD, 2012[25]). The "eligible deforestation" mentioned throuought this document is equivalent to the "net deforestation", estimated as the difference in forest area between two points in time, taking into account both losses from deforestation and gains from forest regeneration and/or tree plantations, divided by the number of years between the two time periods (FAO, 2010[26], 2000[27]). It is called "eligible" because it complies with the VMD0007 requirement "post-deforestation land use shall not

[25] GOFC-GOLD, "A sourcebook of methods and procedures for monitoring and reporting anthropogenic greenhouse gas emissions and removals associated with deforestation, gains and losses of carbon stocks in forests remaining forests, and forestation" (GOFC-GOLD report version COP18-1, GOFC-GOLD Land Cover Project Office, Wageningen University, Netherlands, 2012)
[26] FAO-FRA, "Global forest resources assessment 2010" (FAO forestry paper 163, FAO, Rome, 2010); www.fao.org/forestry/fra/fra2010/en.
[27] FAO-FRA, "On defi nitions of forest and forest change" (Working paper 33, FAO, Rome, 2000).

constitute reforestation" and excludes the areas in the baseline where forest is converted to any other reforestation activity (e.g. cashew, natural regrowth).

To estimate the eligible deforestation, the three land cover maps (2002, 2007, 2010) were combined to produce a single map with all possible transitions among the three land cover classes (i.e., terrestrial forest, mangrove, non-forest) and a single transition matrix was derived from the map for calculation of the total deforestation from each forest class (terrestrial forest and mangrove) during the reference period 2002-2010 ($A_{RRD,unplanned,hrp}$, see section 3.1.4 below). The tables showing the transition matrices obtained through map algebra operations with the landscape state at an initial time and the state of the same pixel at a later time are shown in Table 06 and Table 07.

Table 6. RRD Cacheu. Land cover transitions between the three selected historical dates (2002, 2007, 2010), using a 3-class legend of terrestrial forest (TF), mangrove (M) and non-forest (NF).

Dates			Area (ha)	% Total
2002	2007	2010		
TF	TF	TF	67,621	38.94
TF	TF	M	792	0.46
TF	TF	NF	2,149	1.24
TF	M	TF	1,603	0.92
TF	M	M	560	0.32
TF	M	NF	93	0.05
TF	NF	TF	5,921	3.41
TF	NF	M	239	0.14
TF	NF	NF	2,299	1.32
M	TF	TF	894	0.51
M	TF	M	2,734	1.57
M	TF	NF	215	0.12
M	M	TF	1,407	0.81
M	M	M	76,197	43.88
M	M	NF	1,745	1.01
M	NF	TF	596	0.34
M	NF	M	6,681	3.85
M	NF	NF	1,889	1.09
			173,634	100.00

Table 7. RRD Cantanhez. Land cover transitions between the three selected historical dates (2002, 2007, 2010), using a 3-class legend of terrestrial forest (F), mangrove (M) and non-forest (NF).

Dates			Area (ha)	% Total
2002	2007	2010		
TF	TF	TF	121,840	63.32
TF	TF	M	2,496	1.30
TF	TF	NF	8,099	4.21
TF	M	TF	1,799	0.94
TF	M	M	1,700	0.88
TF	M	NF	466	0.24
TF	NF	TF	2,067	1.07
TF	NF	M	610	0.32
TF	NF	NF	4,069	2.11
M	TF	TF	809	0.42
M	TF	M	1,674	0.87
M	TF	NF	598	0.31

M	M	TF	1,139	0.59
M	M	M	39,773	20.67
M	M	NF	1,664	0.86
M	NF	TF	134	0.07
M	NF	M	1,421	0.74
M	NF	NF	2,075	1.08
			192,432	100.00

3.1.3 Map accuracy assessment

Map accuracy assessment was performed using an independent dataset, i.e. through in situ observations, with field data collected in 2007, 2008, 2009 and 2010 (Forest class), and analysis of very high resolution data (Non-Forest class). Overall accuracy of the 2010 Forest/Non-Forest maps is 95.9% (AA_u=95,5%). With an overall accuracy (AA_u) of 93.9%, the three-class map (Terrestrial-Forest/Mangrove/Non-Forest) was also compliant with the methodological requirement. The confusion matrices used for the calculation of the accuracy parameters (overall accuracy, Kappa coefficient, commission error, and omission error) through simple cross tabulation between the classes of the classified map and the reference data are shown in Tables 8 and 9.

Table 8. Confusion matrix of the 2-class map of Forest/Non-Forest for 2010.

Observed (# pixels)	Predicted (# pixels): Forest	Non-forest	Total	Omission error (%)	Producer's accuracy (%)
Forest	385	13	398	3.3	96.7
Non-forest	7	86	93	7.5	92.5
Total	392	99	491		
Commission error (%)	1.8	13.1			
User's accuracy	98.2	86.9			
Overall accuracy (%)	95.9				
Kappa coefficient	0.87				

Table 9. Confusion matrix of the 3-class map of Terrestrial Forest/Mangrove/Non-Forest for 2010.

Observed (# pixels)	Predicted (# pixels): Terrestrial forest	Mangrove	Non-forest	Total	Omission error (%)	Producer's accuracy (%)
Terrestrial forest	325	3	12	340	4.4	95.6
Mangrove	7	50	1	58	13.8	86.2
Non-forest	6	1	86	93	7.5	92.5
Total	338	54	99	491	–	
Commission error (%)	3.8	7.4	13.1	–	–	–

User's accuracy	96.2	92.6	86.9	–	–	–

Overall accuracy (%)	93.9
Kappa coefficient	0.87

3.1.4 Estimation of the annual areas of unplanned baseline deforestation

As mentioned above, the simple historic default approach for estimation of annual areas of unplanned deforestation was followed. As in this assessment there are only two deforestation time points, the mean area deforested, hectares per year, across the historical reference period was used to calculate the projected area of annual unplanned baseline deforestation in the RRD as:

$$A_{BSL,RRD,unplanned,t} = A_{RRD,unplanned,\hbar rp}/T_{\hbar rp}$$

Where:

$A_{BSL,RRD,unplanned,t}$	Projected area of unplanned baseline deforestation in the RRD in year t; ha
$A_{RRD,unplanned,\hbar rp}$	Total area deforested during the historical reference period in the RRD; ha
$T_{\hbar rp}$	Duration of the historical reference period in years; yr
t	1, 2, 3, ...t years elapsed since the projected start of the REDD project activity

Net deforestation rate in the RRD was 0.62 for Cacheu PA and 1.15 for Cantanhez PA for the entire reference period. The modeled annual area of deforestation in the RRD ($A_{BSL,RRD,unplanned,t}$) of each Project Area was calculated across the historical reference period. The next table (Table 10) shows the values of area of unplanned baseline deforestation in the RRD in year t (ha) ($A_{BSL,RRD,unplanned,t}$) for Cacheu and Cantanhez, both on a gross and eligible (net) deforestation basis.

Table 10. Annual Area of Deforestation in the RRD (ha) in Cacheu and Cantanhez

RRD	–	TF	M
Cacheu	Eligible (ha)	568	481
	Gross (ha)	1,338	1,391
Cantanhez	Eligible (ha)	1,579	542
	Gross (ha)	1,914	736

* TF – Terrestrial Forest, M – Mangrove

In the case of a transition configuration, location analysis is not required as long as it can be shown that ≥ 25% of the project geographic boundary is within 50 m of land that has been anthropogenically deforested within the 10 years prior to the project start date. Since the >25% criterion is met for both Project Areas, location analysis is not required and thus will not be elected. The projected unplanned baseline deforestation in the project area was estimated as follows:

$$A_{BSL,PA,unplanned,t} = A_{BSL,RRD,unplanned,t} * P_{PA}$$

Where:

$A_{BSL,PA,unplanned,t}$	Projected area of unplanned baseline deforestation in the project area in year t; ha
$A_{BSL,RRD,unplanned,t}$	Projected area of unplanned baseline deforestation in the RRD in year t; ha
P_{PA}	Ratio of the project area to the total area of RRD; dimensionless
t	1, 2, 3, ...t years elapsed since the projected start of the REDD project activity

Similarly, the annual area of unplanned baseline deforestation in the leakage belt (Table 5) was estimated as follows:

$$A_{BSL,LK,unplanned,t} = A_{BSL,RRD,unplanned,t} * P_{LK}$$

Where:

$A_{BSL,LK,unplanned,t}$	Projected area of unplanned baseline deforestation in the leakage belt in year t; ha
$A_{BSL,RRD,unplanned,t}$	Projected area of unplanned baseline deforestation in the RRD in year t; ha
P_{LK}	Ratio of the area of the leakage belt to the total area of RRD; dimensionless
t	1, 2, 3, ...t years elapsed since the projected start of the REDD project activity

Table 11. Annual Area of Deforestation in the Project Area (ha) and Leakage Belt (ha)

			Project Area		Leakage Belt	
			TF	M	TF	M
Cacheu	2012	Eligible (ha)	181	153	102	86
		Gross (ha)	426	442	240	250
	2013	Eligible (ha)	181	153	102	86
		Gross (ha)	426	442	240	250
	2014	Eligible (ha)	181	153	102	86
		Gross (ha)	426	442	240	250
	2015	Eligible (ha)	181	153	102	86
		Gross (ha)	426	442	240	250
	2016	Eligible (ha)	181	153	102	86
		Gross (ha)	426	442	240	250
	2017	Eligible (ha)	181	153	102	86
		Gross (ha)	426	442	240	250
	2018	Eligible (ha)	181	153	102	86
		Gross (ha)	426	442	240	250
	2019	Eligible (ha)	181	153	102	86
		Gross (ha)	426	442	240	250

	2020	Eligible (ha)	181	153	102	86
		Gross (ha)	426	442	240	250
	2021	Eligible (ha)	181	153	102	86
		Gross (ha)	426	442	240	250
Cantanhez	2012	Eligible (ha)	742	255	819	281
		Gross (ha)	900	346	992	382
	2013	Eligible (ha)	742	255	819	281
		Gross (ha)	900	346	992	382
	2014	Eligible (ha)	742	255	819	281
		Gross (ha)	900	346	992	382
	2015	Eligible (ha)	742	255	819	281
		Gross (ha)	900	346	992	382
	2016	Eligible (ha)	742	255	819	281
		Gross (ha)	900	346	992	382
	2017	Eligible (ha)	742	255	819	281
		Gross (ha)	900	346	992	382
	2018	Eligible (ha)	742	255	819	281
		Gross (ha)	900	346	992	382
	2019	Eligible (ha)	742	255	819	281
		Gross (ha)	900	346	992	382
	2020	Eligible (ha)	742	255	819	281
		Gross (ha)	900	346	992	382
	2021	Eligible (ha)	742	255	819	281
		Gross (ha)	900	346	992	382

* TF – Terrestrial Forest, M – Mangrove

The total area of unplanned baseline deforestation in the Project Area and Leakage Belt were estimated as follows:

$$A_{BSL,PA,unplanned} = \sum_{t=1}^{t} A_{BSL,PA,unplanned}$$

$$A_{BSL,LK,unplanned} = \sum_{t=1}^{t} A_{BSL,LK,unplanned}$$

Where:

$A_{BSL,PA,unplanned}$	Total area of unplanned baseline deforestation in the project area; ha
$A_{BSL,LK,unplanned}$	Projected area of unplanned baseline deforestation in the leakage belt; ha
$A_{BSL,PA,unplanned,t}$	Projected area of unplanned baseline deforestation in the project area in year t; ha
$A_{BSL,LK,unplanned,t}$	Projected area of unplanned baseline deforestation in the leakage belt in year t; ha
t	1, 2, 3, ...t years elapsed since the projected start of the REDD project activity

3.1.5 Estimation of carbon stocks and carbon stock changes

Estimation of carbon stock changes and GHG emissions followed BL-UP, CP-AB, X-STR and X-UNC. The maps in the following pages display the final delineation of strata in Cacheu and Cantanhez in 2010 as requested by Module X-STR.

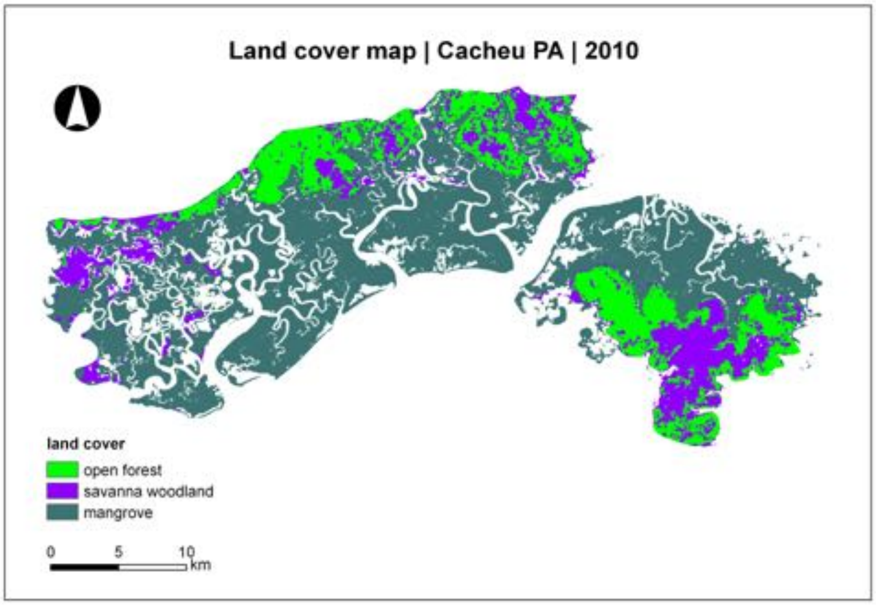


Figure 12. Land Cover Map – all strata – Cacheu 2010

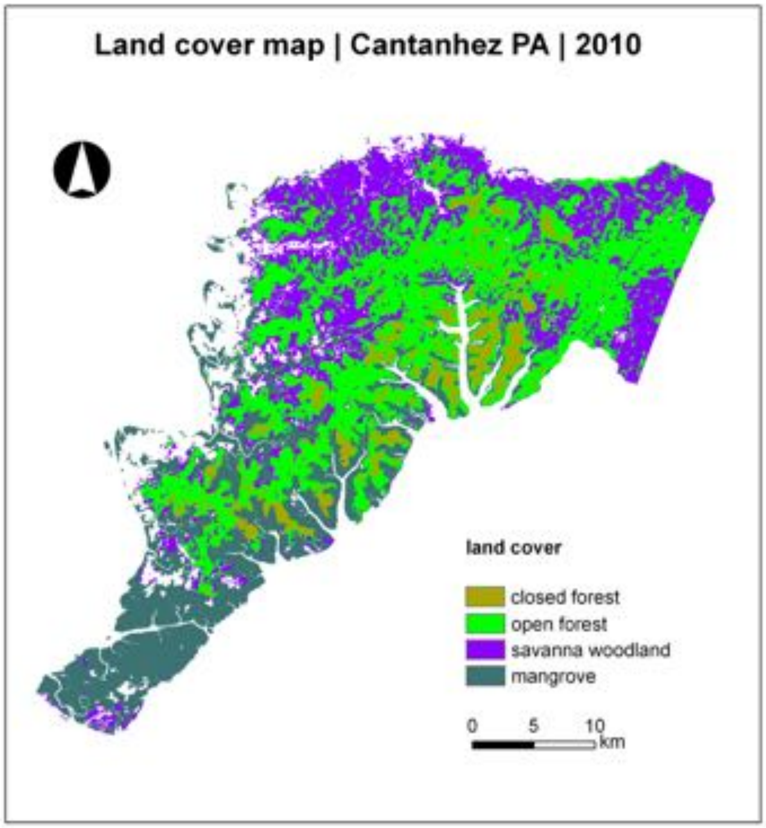


Figure 13. Land Cover Map – all strata – Cantanhez 2010

The method chosen for sampling and estimation of carbon stocks in aboveground tree biomass is described in VMD0001 as "Part 1, Option 1. Fixed Area Plots with Allometric Equation method".

A total of 259 plots were sampled for the carbon stock analysis based on data from the field missions developed under the World Bank (2010 and 2012) and the CARBOVEG-GB (2007, 2008, and 2009) projects. Of the 259 plots, 124 were measured in the Cacheu Protected Area, and 135 in the Cantanhez Protected Area. Field measurements for the carbon stock assessment closely followed the requirements stated in the VM0007 VCS framework and the carbon stock measurement protocols established in Pearson in et al. (2005). Data analyses were also conducted according to the VMD0007 (BL-UP) module. All trees with DBH of ≥5 cm and a minimum height (H) of 1.3 m were measurement in the instaled nested plots. To be representative of all sizes of tree present in sampled parks in GB, measured tree dimensions varied between different forest types.

After running some tests for data verification prior to data processing, on the GB collected data and different models (in more detail below), the project team concluded that the best fit for estimating above-ground biomass (AGB) of trees was the pantropical allometric equation formulated by Chave et al. (2005). Separate equations as a function of climate and primarily the mean monthly evapotranspiration and rainfall were developed by Chave et al. (2005), with these being for wet, moist, and dry forests. Given that forests in GB can be considered dry (Carreiras et al., 2012), the predictive model for dry forests in Chave et al. (2005) was used to estimate the AGB of each live forest tree in all strata (closed forest, open forest, and savanna). When known, species specific wood density was applied. When species was not known or wood density values were not published/available, an average wood density calculated from all other trees was applied. As for mangroves, Chave et al. (2005) common allometric equation for mangroves requiring only two parameters (DBH and wood density) was used. Finally, the conservativea allometric equation listed in both IPCC (2003) and Pearson et al. (2005) was used to estimate the biomass of palm trees. Together with the carbon fraction (CF_j) used, i.e. the standard conversion factor of 0.47 (IPCC, 2006), these equations ($f_j(X, Y \dots)$, in equation below) were used to estimate the carbon stock in aboveground biomass for each individual tree with the equation:

$$C_{AB_{tree,sp,i}} = \sum_{j}^{S} \sum_{l=1}^{N_{j,sp,i}} f_j(X, Y \dots) \times CF_j$$

Where

$C_{AB_{tree,sp,i}}$	Carbon stock in aboveground biomass of trees in plot sp in stratum i; t C
CF_j	Carbon fraction of biomass for species group j; t C t-1 d.m; i.e. 0.47 (IPCC, 2006)
$f_j(X, Y \dots)$	Aboveground biomass of trees based on the above mentioned allometric equation for species group j based on measured tree variable(s); t. d.m. tree-1
i	1, 2, 3, …M strata
j	1, 2, 3 … S tree species
l	1, 2, 3, … Nj,sp,i sequence number of individual trees of species group j in sample plot sp in stratum i

Subsequently, the mean carbon stock in aboveground biomass is calculated for each stratum and converted to carbon dioxide equivalents, using the equation:

$$C_{AB_{tree,i}} = \sum_{sp=1}^{P_i} \frac{C_{AB\_tree,sp,i}}{A_{sp,i}} \times \frac{44}{12}$$

Where:

$C_{AB\_tree,i}$	Mean aboveground biomass carbon stock in stratum i; t CO_2-e ha^{-1}

$C_{AB_{tree,sp,i,t}}$	Aboveground biomass carbon stock of trees in sample plot sp of stratum i , t C
A_{spi}	Area of sample plot sp in stratum i; ha
sp	1, 2, 3, … Pi sample plots in stratum i
i	1, 2, 3, …M strata
44/12	Ratio of molecular weight of CO_2 to carbon, t CO_2-e t C^{-1}

One should note that dividing the aboveground biomass carbon stock of trees in each sample plot ($C_{AB_{tree,sp,i,t}}$) by the area of that plot (A_{spi}) to extrapolate the estimate to the area of a full hectare is equivalent to multiplying the aboveground biomass carbon stock of trees in each sample plot ($C_{AB_{tree,sp,i,t}}$) by a scaling factor, i.e. calculating the proportion of an hectare (10,000 m^2) that is occupied by a given plot (or nest in this case) using a scaling factor. The scaling factor is calculated as follows:

$$Scaling\_factor = \frac{10{,}000m^2}{Area\_plot\left(m^2\right)}$$

The mean carbon stock in belowground tree biomass per unit area was estimated based on field measurements of aboveground parameters in sample plots. Root to shoot ratios were coupled with the allometric equations method used for estimation of aboveground biomass to calculate belowground from aboveground biomass. Option 1 from VMD0001(Fixed area plots with root to shoot ratio) was followed.

For forest trees the below-ground biomass (was estimated using a linear relationship between root biomass and shoot biomass reported by Mokany et al. (2006). The authors developed a root to shoot ratio (RSR) for many different types of vegetation and the relationship reported for tropical dry forest was chosen based on IPCC (1996). The relationship establishes that :

- if AGB < 20 t ha-1, BGB (t ha-1) = 0.56*AGB; or
- if AGB > 20 t ha-1, BGB (t ha-1) = 0.28*AGB

Below-ground biomass is of particular importance in mangroves because mangrove trees accumulate significant portion of its biomass in the roots (Komiyama et al., 2008). However, no root-to-shoot ratios for African mangrove forests were found in the literature. To estimate BGB in mangroves, AGB and BGB data reported by Komiyama et al. (2008) (including data for Indonesia, Australia, Thailand, Panama, and Puerto Rico) was compiled and an average RSR of 0.61 was calculated across all available values. Conservatively the half-width of the 95% confidence interval of the data compiled was used to estimate BGB of mangroves, i.e., the mean AGB:BGB ratio minus the confidence interval value (0.46).

as for palm trees, since there is no dataset available or published that relate above- to below-ground biomass for palm trees, conservatively, belowground carbon stocks of palm trees were omitted.

To estimate the belowground tree biomass carbon stock for each plot the following equation was used:

$$C_{BB_{tree,sp,i}} = R \times C_{AB_{tree,sp,i}}$$

Where:

$C_{BB_{tree,sp,i}}$	Belowground tree biomass carbon stock of trees in plot sp, in stratum i; t C
$C_{AB_{tree,sp,i,t}}$	Aboveground biomass carbon stock of trees in sample plot sp of stratum i , t C (as listed in the text above)
R	Root to shoot ratio; t root d.m. t^{-1} shoot d.m.
i	1, 2, 3, …M strata

Subsequently, the mean belowground tree biomass carbon stock for each stratum was calculated and converted to carbon dioxide equivalents with the following equation:

$$C_{BB_{tree,i}} = \sum_{sp=1}^{P_i} \frac{C_{BB\_tree,sp,i}}{A_{sp,i}} \times \frac{44}{12}$$

Where:

$C_{BB\_tree,i}$	Mean belowground tree biomass carbon stock in stratum i; t CO_2-e ha^{-1}
$C_{BB_{tree,sp,i,t}}$	Mean belowground tree biomass carbon stock of trees in sample plot sp of stratum i , t C
A_{spi}	Area of sample plot sp in stratum i; ha
sp	1, 2, 3, … Pi sample plots in stratum i
i	1, 2, 3, …M strata
44/12	Ratio of molecular weight of CO_2 to carbon, t CO_2-e t C^{-1}

Similarly to what was described above for the expansion of the estimated aboveground biomass in a plot to the area of a full hectare, for belowground biomass the same method of using an expansion factor applies.

For the baseline, only aboveground ($C_{AB\_tree,\ i}$, *tCO_2-e ha^{-1}*) and belowground *($C_{BB\_tree,\ i}$, tCO_2-e ha^{-1})* biomass tree pools were quantified following the equations below:

$$\Delta C_{AB_{tree,i}} = C_{AB_{tree_{bsl},i}} - C_{AB_{tree_{post},i}}$$

$$\Delta C_{BB_{tree_{bsl},i}} = C_{BB_{tree_{BSL},i}} - C_{BB_{tree_{post},i}}$$

Where:

$\Delta C_{AB_{tree},i}$	Baseline carbon stock change in aboveground tree biomass in stratum i; t CO_2-e ha^{-1}
$C_{AB_{tree,BSL},i}$	Forest carbon stock in aboveground tree biomass in stratum i; t CO_2-e ha^{-1}
$C_{AB_{tree,post},i}$	Post-deforestation carbon stock in aboveground tree biomass in stratum i; t CO_2-e ha^{-1}
$\Delta C_{BB_{tree},i}$	Baseline carbon stock change in belowground tree biomass in stratum i; t CO_2-e ha^{-1}
$C_{BB_{tree,bsl},i}$	Forest carbon stock in belowground tree biomass in stratum i; t CO_2-e ha^{-1}
$C_{AB_{tree,post},i}$	Post-deforestation carbon stock in belowground tree biomass in stratum i; t CO_2-e ha^{-1}

As previously mentioned, the main agents of deforestation in GB are the local population, who clear land for subsistence agriculture. The main agricultural product is rice, which is planted in two different systems: dry land rice and wetland rice. Therefore, subsistence agriculture from both dry land and wetland is the only post-deforestation land-use mapped. IPCC default values were applied to the post deforestation carbon stock.

Post-deforestation carbon stock was calculated by independently carrying out the Silva et al. (2011) equation. Through this method, post-deforestaion carbon stock is assumed to be the long-term average stocks on the land following deforestation. For the reasons and deforestation drivers mentioned above, it was assumed that all the land following deforestation enters a shifting cultivation cycle composed of a 2-year cropland period and a 5- to 6-year fallow period (Temudo, 1998). To produce conservative estimates, we used an 8-year shifting cultivation cycle, composed of a 2-year cropland period and a 6-year fallow period. Therefore, and on a spatial basis, we assumed that 2/8 of any post-deforestation area was occupied by cropland and 6/8 by fallow land of different ages (1 to 6 years) in equal proportion. The average post-deforestation C stock in a shifting cultivation cycle with these characteristics is:

$$C_{AB\_post,i} = \left(\frac{2}{8} * C_{crop}\right) + \left(\frac{6}{8} * C_{fallow}\right)$$

Where:

$C_{AB\_post,\,i}$	Long-term average C stock of post deforestation land use i (tC ha^{-1})
C_{crop}	Average C stock of cropland per year (tC ha^{-1} yr^{-1})
C_{fallow}	Average C stock per year of fallow land (tC ha^{-1} yr^{-1})

Only one cropland class was defined under this study: rice production. Since no local study on rice carbon stocks is available, the 5.0 tCha-1 post-deforestation carbon stock from the IPCC (2006) was used as the default biomass carbon stocks present on land converted to cropland in the year following conversion (Table 5.9, chapter 5, Vol. 4 AFOLU, IPCC, 2006).

As for fallow land, an equation initially developed by Zarin et al. (2001) and modified by Silva et al. (2011) was applied to estimate above-ground biomass accumulation following disturbance caused by shifting cultivation practices. The equation estimates above-ground biomass as a function of fallow period and climate data. Different equations were developed according to soil texture (sandy vs. non-sandy), but all the land supporting shifting cultivation in GB were in sandy soils (Silva et al., 2011). Therefore, the following equation was used:

$$AGB_S = -65.8011 + 23.8542 \ln\left(FP \times T \times \frac{L}{365} \right)$$

where:

AGB_s	Aboveground biomass accumulation in sandy soils (tha^{-1})
FP	Fallow period (years)
T	Growing season temperature (°C)
L	Duration of the growing season (days), and L/365 is the duration of the growing season as a fraction of the year)

Both T and L were estimated from climate data, as described in Silva et al. (2011). The analysis and results described in Silva et al. (2011) were produced at the country scale. For Guinea-Bissau the product $Tx\frac{L}{365}$ (named growing season degree years, GSDY) was estimated as 11.5. To obtain this value maps of T (growing season average surface temperature), and L (duration of the growing season, days) were combined (weighted by area) to obtain a unique value of GSDY per country, as described in Silva et al (2011). The previous equation was used to individually estimate the AGB for fallow periods of 1, 2, 3, 4, 5, and 6 years. Subsequently, the average value was computed for those six years as 18.6 tha^{-1}. Using a standard conversion factor of 0.47 (IPCC, 2006), the average C stock is 8.7 $tCha^{-1}$.

Finally, the time-weighted average C stock in post-deforested lands in an 8-year shifting cultivation cycle was calculated as:

$$C_{AB\_post,i} = \frac{2}{8} \times 5.0 + \frac{6}{8} \times 8.7 = 7.8 \ tC\ ha^{-1} \text{ or } 28.6\ tCO_2\text{-}e\ ha^{-1}$$

In total, 125 forest plots were measured in Cacheu and 136 in Cantanhez. Applying the overall average forest stock per hectare to all strata would result in inaccurate estimates (GOFC-GOLD, 2011). Therefore, dividing forest into homogeneous sub-classes (i.e., stratifying by forest type) may improve accuracy of carbon stock and carbon stock change estimates. Although the maps produced only stratify forest into terrestrial forest and mangrove, an additional stratification exercise was anticipated in the field work plan that preceded the collection of field data in all field campaigns (2007, 2008, 2009, 2010, and 2012). Following VMD0016, CARBOVEG-GB maps were used as ancillary data and as a proxy for potential biomass classes and area estimation. The pre-stratification of the project area into the following forest sub-classes contributed to avoiding post measurement stratification:

- Closed Forest
- Open Forest
- Savanna Woodland
- Mangrove

VMD0017 uses the target precision of 15% (for a confidence interval of 95%). An estimate of the additional number of plots required to reduce uncertainty of carbon stocks and achieve the VMD0017 module precision target was performed prior to the fieldwork. Table 12 presents the average carbon stock per stratum in Cacheu and Cantanhez Project areas.

Table 12. Average carbon stocks per stratum in the Project Area

Project Area	Stratum	Area (ha)	# of Plots	AGB carbon stock ($C_{AB\_tree,\ i}$, tCO_2-eha^{-1})	BGB carbon stock ($C_{BB\_tree,\ i}$, tCO_2-eha^{-1})
Cacheu	Open Forest	14,509	69	132.9	35.2
	Savanna	4,438	18	97.7	26.5
	Mangrove	33,596	37	72.9	33.4
Cantanhez	Closed Forest	6,915	45	306.11	84.2
	Open Forest	45,659	46	127.0	33.8
	Savanna	14,195	18	101.4	28.2
	Mangrove	22,144	26	100.45	46.0

The sum of the baseline carbon stock changes was calculated under the business as usual at the end of the 10-year period by applying the estimated deforestation per year to the stratum with the lowest carbon stock for each project area and leakage belt using the equations below:

$$\Delta C_{TOT} = \sum_{t=1}^{t}\sum_{i=1}^{M} \Delta C_{BSL,i,t}$$

$$\Delta C_{BSL,i,t} = A_{unplanned,i,t} \times \Delta C_{AB_{tree},i} + \sum_{t-10}^{t} A_{unplanned,i,t} \times \Delta C_{BB_{tree},i} \times \frac{1}{10}$$

Where:

ΔC_{TOT} Sum of the baseline carbon stock change in all pools up to time t; t CO_2-e (calculated separately for the project area and the leakage belt;

$\Delta C_{BSL,i,t}$	Sum of the baseline carbon stock change in all pools in stratum i at time t, t CO_2-e
$A_{unplanned,i,t}$	Area of unplanned deforestation in forest stratum i at time t; ha
$\Delta C_{AB_{tree},i}$	Baseline carbon stock change in aboveground tree biomass in stratum i; t CO_2-e ha^{-1}
$\Delta C_{AB_{tree},i}$	Baseline carbon stock change in aboveground tree biomass in stratum i; t CO_2-e ha^{-1}
$\Delta C_{BB_{tree},i}$	Baseline carbon stock change in belowground tree biomass in stratum i; t CO_2-e ha^{-1}
i	1, 2, 3, … M strata
t	1, 2, 3, ...t years elapsed since the projected start of the REDD project activity

As no location analysis has been conducted, annual deforestation area is given directly by $A_{BSL,PA,\ unplanned,t}$ for the Project Area and $A_{BSL,LK,\ unplanned,\ t}$ for the Leakage Belt. The cumulative carbon stock change under the business as usual in each Project Area is shown below

Table 13. Cumulative Carbon Stock Changes in the BAU in the Project Area(tCO_2e)

		$\Delta C_{BSL,i}$ (tCO_2-e)									
PA	Stratum	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Cacheu	Terrestrial Forest	12,949	26,377	40,282	54,667	69,529	84,870	100,690	116,987	133,763	151,018
	Mangrove	7,283	15,078	23,383	32,200	41,527	51,366	61,715	72,576	83,948	95,831
	ΔC_{TOT} (tCO_2e)	20,232	41,454	63,666	86,866	111,056	136,236	162,405	189,563	217,711	246,849
Cantanhez	Terrestrial Forest	56,119	114,329	174,632	237,026	301,513	368,091	436,761	507,523	580,377	655,323
	Mangrove	19,468	40,108	61,920	84,905	109,063	134,392	160,894	188,569	217,416	247,435
	ΔC_{TOT} (tCO_2e)	75,586	154,437	236,552	321,932	410,575	502,483	597,655	696,092	797,793	902,758

The cumulative carbon stock change under the business as usual in each Leakage Belt is shown below.

Table 14. Cumulative Carbon Stock Changes in the BAU in the Leakage Belt (tCO_2e)

		$\Delta C_{BSL,i}$ (tCO_2-e)									
LK	Stratum	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Cacheu	Terrestrial Forest	7,310	14,890	22,740	30,860	39,251	47,911	56,841	66,042	75,512	85,252
	Mangrove	4,112	8,512	13,200	18,177	23,443	28,997	34,840	40,971	47,390	54,098

	ΔC_{TOT} (tCO_2e)	11,422	23,402	35,940	49,038	62,693	76,908	91,681	107,012	122,902	139,351
Cantanhez	Terrestrial Forest	61,911	126,130	192,657	261,491	332,634	406,084	481,842	559,908	640,281	722,963
	Mangrove	21,477	44,248	68,312	93,669	120,320	148,264	177,501	208,032	239,857	272,974
	ΔC_{TOT} (tCO_2e)	83,388	170,378	260,968	355,160	452,953	554,348	659,343	767,940	880,138	995,937

The sum of the baseline carbon stock change (ΔC_{TOT}) in each project area and leakage belt is the difference between the total forest carbon stock and the total post-deforestation carbon stock change under business as usual. The sum of the baseline carbon stock change in all pools up to the 10^{th} year of the current baseline scenario are shown below. The wood products pool (C_{WP}) was excluded since this pool is only mandatory where the process of deforestation involves timber harvesting for commercial markets, which is not applicable to the project.

Table 15. Total Carbon Stock Change (tCO_2e)

		ΔC_{TOT} (tCO_2-e)
Cacheu	PA	246,849
	LB	139,351
Cantanhez	PA	902,758
	LB	995,937

*PA – Project Area, LB – Leakage Belt

The GHG emissions were accounted as zero in the calculation of net emissions (Table 10) and therefore, the net GHG emissions in the baseline was calculated as follows:

$$\Delta C_{BSL,unplanned} = \Delta C_{BSL,PA,unplanned} + 0$$

$$\Delta C_{BSL,PA,unplanned} = \Delta C_{TOT,PA}$$

Where:

$\Delta C_{BSL,unplanned}$	Net greenhouse gas emissions in the baseline from unplanned deforestation; t CO_2-e
$\Delta C_{BSL,PA,unplanned}$	Net CO_2 emissions in the baseline from unplanned deforestation in the project area; t CO_2-e
$\Delta C_{TOT,PA}$	Sum of the baseline carbon stock change in all pools up to time t in the project area; t CO_2-e

Table 16. Net emissions reductions from avoiding unplanned deforestation in the baseline scenario.

	$\Delta C_{BSL,PA,unplanned}$ (tCO_2e)	$GHG_{BLS,E}$ (tCO_2e)	$\Delta C_{BSL,unplanned}$ (tCO_2e)
Cacheu	246,849	0	246,849
Cantanhez	902,758	0	902,758

The next table shows the net emissions in the baseline from unplanned deforestation estimated as the sum at the end of the 10-year period.

Table 17. Net emissions in the Baseline Scenario (tCO_2e)

		$\Delta C_{BSL,unplanned}$ (tCO_2e)				
		2012	2013	2014	2015	2016
Cacheu	$\Delta C_{BSL,PA,unplanned}$ (tCO_2e)	20,232	41,454	63,666	86,866	111,056
	$\Delta C_{BSL,unplanned}$ (tCO_2e)	20,232	41,454	63,666	86,866	111,056
Cantanhez	$\Delta C_{BSL,PA,unplanned}$ (tCO_2e)	75,586	154,437	236,552	321,932	410,575
	$\Delta C_{BSL,unplanned}$ (tCO_2e)	75,586	154,437	236,552	321,932	410,575

		$\Delta C_{BSL,unplanned}$ (tCO_2e)				
		2017	2018	2019	2020	2021
Cacheu	$\Delta C_{BSL,PA,unplanned}$ (tCO_2e)	136,236	162,405	189,563	217,711	246,849
	$\Delta C_{BSL,unplanned}$ (tCO_2e)	136,236	162,405	189,563	217,711	246,849
Cantanhez	$\Delta C_{BSL,PA,unplanned}$ (tCO_2e)	502,483	597,655	696,092	797,793	902,758
	$\Delta C_{BSL,unplanned}$ (tCO_2e)	502,483	597,655	696,092	797,793	902,758

3.2 Project Emissions

This section describes the procedure for ex-post quantification of project emissions in accordance with VMD0007 due to deforestation within the project area and leakage belt, forest degradation through extraction of trees for illegal timber and fuelwood and charcoal, and as result of natural disturbance, including fire. This section also provides explanation and justifications for developing the ex-ante estimate of the respective output parameters. Net greenhouse gas emissions within the project area under the project scenario (ΔC_P) within the project area and the leakage belt are calculated according to M-MON (v2.1) module. In the case of the proposed project activity three emissions sources are anticipated, potential net carbon stock changes as a result of (i) deforestation in the project area ($\Delta C_{P,DefPA,i,t}$) and the leakage belt ($\Delta C_{P,DefLB,i,t}$) in the project case. If the PRA indicates forest (ii) degradation is taking place in the project area, such emissions must be calculated ($\Delta C_{P,DegW,i,t}$). Finally, although emissions due to (iii) natural disturbances are not expected, this section also presents relevant equations and justification of methodological choices for the calculation of ex-post net carbon stocks changes as a result of natural disturbance[28] ($AC_{P,DistPA,i,t}$).

Carbon stocks changes from forest degradation ($\Delta C_{P,DegW,i,t}$) are accounted as zero for the ex-ante estimate. As demonstrated in the PRA, carbon stock changes from wood extraction in the project area are considered insignificant. The PRA must be updated every two years and if the results suggest that there is a potential for degradation activities, then limited field sampling must be undertaken to delineate the areas that are potentially subjected to degradation. Net carbon stock changes as a result of degradation shall be estimated according to the equations below:

Where the PRA or limited sampling indicate no degradation is occurring:

$$\Delta C_{P,DegW,i,t} = 0$$

Where the PRA and the limited sampling indicate degradation is occurring:

$$\Delta C_{P,DegW,i,t} = A_{DegW,i} * \frac{C_{DegW,I,t}}{AP_i}$$

Where:

$\Delta C_{P,DegW,i,t}$	Net Carbon stock changes as a result of degradation in stratum I in project area at time t; tCO_2e
$A_{DegW,i}$	Area potentially impacted by degradation processes in stratum i; ha
$C_{DegW,I,t}$	Biomass carbon of trees cut and removed through degradation process from plots measured in stratum I at time t; tCO_2e
AP_i	Total area of degradation sample plots in stratum i; ha
i	1,2,3…M strata
t	1,2,3… t* years elapsed since the start of the REDD project activity

Carbon Dioxide (CO_2) emissions are fully accounted in the net carbon stock change. Other GHG gases like methane (CH_4) and nitrous oxide (N_2O) are not expected to be relevant because: IBAP activities do not include fire use ($E_{BiomassBurn,i,t}$) or nitrogen fertilization ($N2O_{direct-N,i,t}$). Patrolling is done by the local communities on foot, therefore fossil fuel use is also not relevant ($E_{FC,i,t}$).

For the project area the net greenhouse gas emissions in the project case is equal to the sum of stock changes due to deforestation, degradation and natural disturbance:

[28] According to the M-MON module such disturbances include tectonic activities, extreme weather, pest, drought or fire that result in a degradation of forest carbon stocks.

$$\Delta C_P = \sum_{t=1}^{t^*} \sum_{i=1}^{M} (\Delta C_{P,DefPA,i,t} + \Delta C_{P,Deg,i,t} + \Delta C_{P,DistPA,i,t})$$

Where:

ΔC_P	Net greenhouse has emissions within the project area under the project scenario; tCO_2e
$\Delta C_{P,DefPA,i,t}$	Net carbon stock change as a result of deforestation in the project area in the project case in stratum i at time t, tCO_2e
$AC_{P,Deg,i,t}$	Net carbon stock changes as a result of degradation in the project area in the project case in stratum i at time t, tCO_2e
$AC_{P,DistPA,i,t}$	Net carbon stock changes as a result of the natural disturbance in the project area in the project case in stratum i at time t, tCO_2e
i	1,2,3...M strata (Closed Forest, Open Forest, Savanna, Mangrove)
t	1,2,3... t* years elapsed since the start of the REDD project activity

For the leakage belt the net greenhouse gas emissions in the project case is equal to the sum of stock changes due to deforestation in the leakage belt:

$$\Delta C_{P,LB} = \sum_{t=1}^{t^*} \sum_{i=1}^{M} \Delta C_{P,DefLB,i,t}$$

Where:

$\Delta C_{P,LB}$	Net greenhouse has emissions within the leakage belt under the project scenario; tCO_2e
$\Delta C_{P,DefLB,i,t}$	Net carbon stock change as a result of deforestation in the leakage belt in the project case in stratum i at time t, tCO_2e
i	1,2,3...M strata (Closed Forest, Open Forest, Savanna, Mangrove)
t	1,2,3... t* years elapsed since the start of the REDD project activity

Land-use and land-cover (LU/LC) change data must be collected for each monitoring period. Medium resolution remotely sensed spatial data should be used (e.g. Landsat). Data to identify and quantify (ha) the area deforested ($A_{Def,PA,u,i,t}$) and burned ($A_{burn,i,t}$) in the project area and the area deforested ($A_{Def,LB,u,i,t}$) in the leakage belt must cover the entire project area and leakage belt. Data shall be available for the year in which monitoring and verification is occurring. The area of each category change will be calculated within the project area and, where required, the leakage belt at the end of each monitoring period.

Net carbon changes due to deforestation

Net carbon stock changes as a result of deforestation is equal to the area deforested multiplied by the emission per unit area. The calculation is performed according to Equations 3 and 4 of M-MON.

$$\Delta C_{P,DefPA,i,t} = \sum_{u=1}^{U} (A_{DefPA,u,i,t} * \Delta C_{pools,P,Def,u,i,t})$$

$$\Delta C_{P,DefLB,i,t} = \sum_{u=1}^{U} (A_{DefLB,u,i,t} * \Delta C_{pools,P,Def,u,i,t})$$

Where:

$\Delta C_{P,DefPA,i,t}$	Net carbon stock changes as a result of deforestation in the project case in the project area in stratum i at time t; tCO_2e
$\Delta C_{P,DefLB,i,t}$	Net carbon stock change as a result of deforestation in the project case in the leakage belt in stratum i at time t, tCO_2e
$A_{DefPA,u,i,t}$	Area of recorded deforestation in the project area stratum i converted to land use u ate time t; ha
$A_{DefLB,u,i,t}$	Area of recorded deforestation in the leakage belt stratum i converted to land use u ate time t; ha
$\Delta C_{pools,P,Def,u,i,t}$	Net carbon stock change in all pools in the project case in land use u in stratum i at time t; tCO_2e
u	1,2,3...U post-deforestation land uses (Temudo, 1998; Silva et al., 2011: 8 year shifting cultivation cycle)
i	1,2,3...M strata (Closed Forest, Open Forest, Savanna, Mangrove)
t	1,2,3... t* years elapsed since the start of the REDD project activity

The emission per unit area is equal to the difference between the stocks before and after deforestation minus any wood products created from timber extraction in the process of deforestation as shown in the next equation (Equation 5 of M-MON). It is conservative in the project case to assume no wood products are produced.

$$\Delta C_{pools,Def,u,i,t} = C_{BSL,i} - C_{P,post,u,i} - C_{WP,i}$$

Where:

$\Delta C_{pools,Def,u,i,t}$	Net carbon stock change in all pools as a result of deforestion in the project case in land use u in stratum i at time t; tCO_2e
$C_{BSL,i}$	Carbon stock in all pools in the baseline case in stratum i, tCO_2e
$C_{P,post,u,i}$	Carbon stock in all pools in post-deforestation land use u in stratum i, tCO_2e
$C_{WP,i}$	Carbon stock sequestrered in wood products from harvests in stratum i, tCO_2e
u	1,2,3...U post-deforestation land uses (Temudo, 1998; Silva et al., 2011: 8 year shifting cultivation cycle)
i	1,2,3...M strata (Closed Forest, Open Forest, Savanna, Mangrove)
t	1,2,3... t* years elapsed since the start of the REDD project activity

Therefore, $\Delta C_{pools,P,Def,u,i,t}$ is equal to the carbon stock in the baseline case in the project area and leakage belt (see Section 3.1) minus the post deforestation carbon stock. Instead of tracking annual emissions through burning and/or decomposition, the project employs the simplifying assumption that all carbon stocks are emitted in the year deforested.

For each post-deforestation land use (u) the project shall estimate the long-term carbon stock. Carbon stocks in the selected pools are the same used for the project baseline quantification, measured and estimated using the methods in the module CP-AB ($C_{AB_{tree},i}$ and $C_{BB_{tree},i}$). The calculation of carbon stocks in all pools in post-deforestation land use is performed according to Equations 6 of M-MON.

$$C_{post,u,i} = C_{AB_{tree},i} + C_{BB_{tree},i}$$

Where:

$C_{post,u,i}$	Carbon stock in all pools in post-deforestation land use u in stratum i, $tCO_2e\ ha^{-1}$
$C_{AB_{tree},i}$	Carbon stock in aboveground tree biomass in stratum i, $tCO_2e\ ha^{-1}$
$C_{BB_{tree},i}$	Carbon stock in belowground tree biomass in stratum i, $tCO_2e\ ha^{-1}$

In the project case, post-deforestation land use only considers an 8-year shifting cultivation cycle (2-year cropland period and 6-year fallow period) described by Temudo (1998) and Silva et al. (2011). As calculated in the spreadsheet WB2 – C assessment and emissions baseline v2.3.xlsx, $C_{AB\_tree,i}$ is equal 28.6 $tCO_2e.ha^{-1}$.

Net carbon changes in areas undergoing natural disturbances

Apart from monitoring emissions from deforestation, the project will also monitor net carbon changes in areas undergoing natural disturbances. Therefore, project emissions consider net carbon stock changes as a result of natural disturbances in the project area, including non-CO_2 emissions (CH_4 and N_2O) in case of fire. Emissions due to fire are calculated according to the module E-BB (v1.0). Carbon dioxide emissions are not included as project emission from natural disturbance since it is fully accounted through stock changes. The module M-MON (v2.1) provides the procedures to the monitoring of data and parameters used for verification, in the project area, in case natural disturbances happen. For fire ($A_{Burn,i,t}$), the module makes specific reference to the E-BB module to calculate the parameter $E_{BiomassBurn,i,t}$. Finally, carbon stocks in aboveground biomass in trees on each stratum ($C_{AB_{tree},i,t}$) is calculated according to CP-AB (v1.1) module.

Where natural disturbance occurs ex-post in the project area the area disturbed shall be delineated and the resulting emissions estimated. Emissions resulting from natural disturbances may be omitted if they are deemed de minimis through the use of the module T-SIG. Net carbon stock changes as a result of natural disturbance in the project case in the project area shall be determined as:

$$\Delta C_{P,DistPA,i,t} = \sum_{q=1}^{Q} (A_{DisPA,q,i,t} * \Delta C_{P,Dist,q,i,t})$$

Where:

$\Delta C_{P,DistPA,i,t}$	Net carbon stock change as a result of natural disturbance in the project case in the project area in stratum i at time t; tCO_2e
$A_{DisPA,q,i,t}$	Area impacted by natural disturbance in post-natural disturbance stratum q in stratum i, at time t; ha
$\Delta C_{P,Dist,q,i,t}$	Net carbon stock changes in pools as a result of natural disturbance in post-natural disturbance stratum q in stratum I at time t; tCO_2e
q	1,2,3...Q post-natural disturbance strata
i	1,2,3...M strata (Closed Forest, Open Forest, Savanna, Mangrove)
t	1,2,3... t* years elapsed since the start of the REDD project activity

Where natural disturbance in post-natural disturbance stratum q included fire, the area burned shall be assumed to be equal to the area impacted by natural disturbance in post-natural disturbance stratum q. Therefore:

$$A_{Burn,i,t} = \sum_{q=1}^{Q} A_{Burn,q,i,t}$$

$A_{Burn,q,i,t} = A_{DisPA,q,i,t}$ for stratum where the natural disturbance included fire

Where:

$A_{DisPA,q,i,t}$	Area impacted by natural disturbance in post-natural disturbance stratum q in stratum i, at time t; ha
$A_{Burn,q,i,t}$	Area burnt in post-natural disturbance stratum q in stratum i, at time t; ha
q	1,2,3...Q post-natural disturbance strata where the natural disturbance included fire
i	1,2,3...M strata (Closed Forest, Open Forest, Savanna, Mangrove)
t	1,2,3... t* years elapsed since the start of the REDD project activity

Non-CO_2 emissions from woody biomass burning, in case fire occurs in the project area, are estimated based on IPCC 2006 Inventory Guidelines, as detailed in E-BB module, and shall be determined as:

$$E_{BiomassBurn,i,t} = \sum_{g=1}^{G} \left(\left(\left(A_{Burn,i,t} * B_{i,t} * COMF_i * G_{g,i} \right) * 10^{-3} \right) * GWP_g \right)$$

Where:

$E_{BiomassBurn,i,t}$	Greenhouse emissions due to biomass burning as part of deforestation activities in stratum i in year t; tCO_2-e of each GHG (CH_4 and N_2O)
$A_{Burn,i,t}$	Area burnt in stratum i in year t; ha
$B_{i,t}$	Average aboveground biomass stock before burning stratum i in year t; tonnes d.m.ha^{-1}
$COMF_i$	Combustion factor for stratum i in year t; dimensionless (default IPCC value according to Annex 1 of E-BB)

$G_{g,i}$	Emission factor for stratum i for gas g; kg.t^{-1} dry matter burnt (default IPCC value according to Annex 2 of E-BB)
GWP_g	Global Warming Potential for gas g; tCO_2/t gas g (default IPCC SAR)
g	Greenhouse gas included in project emissions due to burning (CH_4 and N_2O)
i	1,2,3...M strata (Closed Forest, Open Forest, Savanna, Mangrove)
t	1,2,3... t* years elapsed since the start of the REDD project activity

The table below presents the default values to be applied.

Parameter	Value	Source
$COMF_{Closed\ Forest}$	0.32	E-BB, v1.0 Annex 1. Primary Tropical Forest.
$COMF_{Open\ Forest}$	0.45	E-BB, v1.0 Annex 1. Primary Open Tropical Forest.
$COMF_{Savanna}$	0.72	E-BB, v1.0 Annex 1. Savanna Woodland (mid/late dry season burns)
$COMF_{Mangrove}$	0.36	E-BB, v1.0 Annex 1. All Primary Tropical Forest.
$G_{CH4,Closed\ Forest}$	6.80	E-BB, v1.0 Annex 2. Tropical Forest
$G_{N2O,Closed\ Forest}$	0.20	E-BB, v1.0 Annex 2. Tropical Forest
$G_{CH4,Open\ Forest}$	6.80	E-BB, v1.0 Annex 2. Tropical Forest
$G_{N2O,Open\ Forest}$	0.20	E-BB, v1.0 Annex 2. Tropical Forest
$G_{CH4,Savanna}$	2.30	E-BB, v1.0 Annex 2. Savanna and grassland
$G_{N2O,Savanna}$	0.21	E-BB, v1.0 Annex 2. Savanna and grassland
$G_{CH4,Mangrove}$	4.70	E-BB, v1.0 Annex 2. Extra tropical forest (all other forest type)
$G_{N2O,Mangrove}$	0.26	E-BB, v1.0 Annex 2. Extra tropical forest (all other forest type)
GWP_{CH4}	21	IPCC SAR
GWP_{N2O}	310	IPCC SAR

The sources of all default values are presented on the table and the rationale for the application of each value to a particular stratum is based on IPCC (2006) stratification factors that consider, amongst other aspects, climate and ecological zones. For closed forest, open forest and savanna Annexes 1 and 2 of E-BB present specific values considering a general vegetation type and specific subcategories, therefore, values for each stratum could be identified. In the case of mangroves, the mentioned annexes do not present specific values for this vegetation type. Therefore, considering climate and ecological zones of the Project Area the best fits are the combustion factor for “All primary tropical forests” on Annex 1 and the emission factor for “Extra Tropical Forest” which considers all other forest types not listed on the table.

The monitoring of the area burned for each stratum at any given period $(A_{Burn,i,t})$ is performed according to M-MON module (v2.1). The net carbon stock change as a result of fire is equal to the area burn multiplied by the emission per unit area as defined in E-BB. Land-use and land-cover (LU/LC) change data must be collected for each monitoring period. Medium resolution remotely sensed spatial data should be used (e.g. Landsat). Data to identify and quantify (ha) the area burned must cover the entire project area. Data shall be available for the year in which monitoring and verification is occurring.

The average aboveground biomass stock before burning for a particular stratum is estimated as follows:

$$B_{i,t} = \left(C_{AB_{tree},i,t}\right) * {}^{12}/_{44} * {}^{1}/_{CF}$$

Where

$B_{i,t}$	Average aboveground biomass stock before burning for stratum i, time t, tonnes of d.m.ha^{-1}
$C_{AB_{tree},i,t}$	Mean aboveground biomass carbon stock in stratum i at time t, tCO2e ha^{-1} (estimated using CP-AB)
${}^{12}/_{44}$	Inverse ratio of molecular weight of CO_2 to carbon, $tCO_2e\ tC^{-1}$
CF	Carbon fraction of biomass, $tC\ t^{-1}$ d.m
i	1,2,3...M strata (Closed Forest, Open Forest, Savanna, Mangrove)
t	1,2,3... t* years elapsed since the start of the REDD project activity

Parameter	Value	Source
$C_{AB_{tree},\text{Closed Forest},\text{Cantanhez},t=0}$	306.11	WB2 – C assessment and emissions baseline v2.3. Value for Closed Forest in Cantanhez.
$C_{AB_{tree},\text{Open Forest},\text{Cantanhez},t=0}$	127.01	WB2 – C assessment and emissions baseline v2.3. Value for Open Forest in Cantanhez.
$C_{AB_{tree},\text{Savanna},\text{Cantanhez},t=0}$	101.43	WB2 – C assessment and emissions baseline v2.3. Value for Savanna in Cantanhez.
$C_{AB_{tree},\text{Mangrove},\text{Cantanhez},t=0}$	100.45	WB2 – C assessment and emissions baseline v2.3. Value for Mangrove in Cantanhez.
$C_{AB_{tree},\text{Open Forest},\text{Cacheu},t=0}$	132.88	WB2 – C assessment and emissions baseline v2.3. Value for Open Forest in Cacheu.
$C_{AB_{tree},\text{Savanna},\text{Cacheu},t=0}$	97.70	WB2 – C assessment and emissions baseline v2.3. Value for Savanna in Cacheu.
$C_{AB_{tree},\text{Mangrove},\text{Cacheu},t=0}$	72.89	WB2 – C assessment and emissions baseline v2.3. Value for Mangrove in Cacheu.
CF	0.47	IPCC 2006, Chapter 4, Table 4.3

The emission per unit area is equal to the difference between the stocks before and the stocks after natural disturbance, as follows:

$$\Delta C_{P,Dist,q,i,t} = C_{BSL,i} - C_{P,Dist,q,i}$$

Where:

$\Delta C_{P,Dist,q,i,t}$	Net carbon stock changes in pools as a result of natural disturbance in the project case in post-natural disturbance stratum q in stratum i at time t; $tCO_2e\ ha^{-1}$
$C_{BSL,i}$	Carbon stock in all pools in the baseline case in stratum i: $tCO_2e\ ha^{-1}$
$C_{P,Dist,q,i}$	Carbon stock in pools in post-natural disturbance strata q in stratum i; $tCO_2e\ ha^{-1}$

Instead of tracking annual emissions through burning and/or decomposition, the methodology employs the simplifying assumption that all carbon stocks are emitted in the year the natural disturbance occurs. For each post-natural disturbance stratum (q) estimate the carbon stock following the natural disturbance. Carbon stocks must be estimated using the module CP-AB and measurement uncertainty assessed using X-UNC. It is conservative to assume that post-natural disturbance ABG pool is equal to zero.

$$C_{P.Dist,q,i} = C_{AB_{tree},i} + C_{BB_{tree},i}$$

Where:

$C_{P,Dist,q,i}$	Carbon stock in all pools in post-natural disturbance q in baseline stratum i; $tCO_2e\ ha^{-1}$
$C_{AB\_tree,i}$	Carbon stock in aboveground tree biomass in stratum i: $tCO_2e\ ha^{-1}$
$C_{BB\_tree,i}$	Carbon stock in belowground tree biomass in stratum i; $tCO_2e\ ha^{-1}$
q	1,2,3…Q post-natural disturbance strata
i	1,2,3...M strata (Closed Forest, Open Forest, Savanna, Mangrove)

For ex-ante emission calculation purpose, project emissions are considered to be zero for three reasons: (1) the project areas do not have a history of natural disturbance, (2) the PRA does not indicate fire is relevant in the project area, following methodological requirements the PRA will be updated every two years, and (3) deforestation in the project area is not expected since IBAP holds permanent presence in Cacheu and Cantanhez. Park guards are monitoring the area and communities approved the internal regulations and agreed to protect the forests inside the project. Therefore, $A_{DefPA,u,i,t} = 0$. Similarly, since natural disturbance is not expected in the project area, $A_{DistPA,q,i,t}$ was also considered zero for ex-ante quantification purpose. Finally, since the PRA did not indicated degradation is occurring $A_{DegW,i} = 0$.

3.3 Leakage

Leakage emissions accounted for are entirely from displacement of unplanned deforestation and were estimated applying the LK-ASU (v1.0) module. Leakage due to market effects is considered zero because the project is not anticipated to impact any commercial harvesting activity.

The initial PRA indicated that the agents of deforestation comprise in majority the local population ($PROP_{RES}$=90.7%) performing agriculture activities, leakage emissions ($\Delta C_{LK-AS,unplanned}$) comprise potential emissions from displacement of this activity. As discussed previously, the proposed REDD project includes strong leakage prevention measures through FIAL. Both the micro scale and the participatory model aim at increasing the effectiveness of FIAL. FIAL has two windows, one for community development and one for mitigation measures necessitated by the collective determination of restrictions on access to resources. Community development measures are those that are validated by the entire community, benefiting either the community at large and/or a chosen subgroup e.g., wells, boats, schools, clinics, and alternative technology and/or income generating activities such as new agricultural processing technologies, bee keeping, horticulture and other initiatives that are available to everyone in the community. Mitigation measures, by contrast, are initiatives that benefit only those people who lost access, in whole or in part, to a specific resource.

For the ex-ante leakage estimation it is considered a 20% leakage factor based on the failure rate of FIAL according to independent evaluations of the 129 projects historically financed by the mechanism. $PROP_{IMM}$ is equal to 9.3% following the results of the PRA. Leakage is calculated as the difference between project and baseline emissions in the leakage belt. Ex-ante estimates of the net CO_2 emissions due to unplanned deforestation displaced from the project area to the leakage belt is calculated for each year in the baseline period following Equation 1 from LK-ASU Module. Moreover, no emission is expected as a result of leakage avoidance measures.

$$\Delta C_{LK-ASU-LB} = \Delta C_{P,LB} - \Delta C_{BSL,LK,unplanned}$$

Where:

$\Delta C_{LK-ASU-LB}$ Net CO_2 emissions due to unplanned deforestation displaced from the project area to the leakage belt; tCO_2e

$\Delta C_{P,LB}$ Net GHG emissions within the leakage belt in the project case; tCO_2e. Ex-ante estimate calculated based on a 20% emissions displacement factor from the project area to the leakage belt. This result is added to the estimated baseline for the leakage belt.

$\Delta C_{BSL,LK,unplanned}$ Net CO_2 emissions in the baseline form unplanned deforestation in the leakage belt; tCO_2e

Table 18. Estimated net CO_2 emissions due to unplanned deforestation caused by local agents displaced from the project area to the Leakage Belt

Year	$\Delta C_{BSL,unplanned}$	Leakage Factor (20%)	$\Delta C_{P,LB}$	$\Delta C_{BSL,LK,unplanned}$	$\Delta C_{LK-ASU-LB}$
2013	95,819	19,164	113,974	94,810	19,164
2014	195,891	39,178	232,958	193,779	39,178
2015	300,218	60,044	356,952	296,909	60,044
2016	408,798	81,760	485,957	404,198	81,760
2017	521,632	104,326	619,973	515,647	104,326
2018	638,719	127,744	758,999	631,255	127,744
2019	760,061	152,012	903,036	751,024	152,012
2020	885,656	177,131	1,052,083	874,952	177,131
2021	1,015,504	203,101	1,206,141	1,003,040	203,101
2022	1,149,607	229,921	1,365,210	1,135,288	229,921
2023	1,245,426	249,085	1,479,183	1,230,098	249,085
2024	1,345,498	269,100	1,598,167	1,329,068	269,100
2025	1,449,825	289,965	1,722,162	1,432,197	289,965
2026	1,558,405	311,681	1,851,167	1,539,486	311,681
2027	1,671,239	334,248	1,985,183	1,650,935	334,248
2028	1,788,326	357,665	2,124,209	1,766,544	357,665
2029	1,909,667	381,933	2,268,246	1,886,312	381,933

2030	2,035,262	407,052	2,417,293	2,010,241	407,052
2031	2,165,111	433,022	2,571,351	2,138,329	433,022
2032	2,299,214	459,843	2,730,419	2,270,576	459,843
Total	23,439,877	4,687,975	27,842,663	23,154,687	4,687,975

The estimation of unplanned deforestation displaced from the project area to outside the Leakage Belt considers immigrants prevented from migrating into and deforesting the project area. The available national forest area (TOTFOR) is calculated according to the equation 2 of LK-ASU Module. TOTFOR is derived from the national forest cover provided officially in the Second National Communication on Climate Change in Guinea-Bissau (UNFCCC, 2011[29]). The value applied is 2,683,290 ha. Conservatively, PROTFOR and MANFOR are considered zero, therefore, all national forest areas are considered available for deforestation displaced from the project area to outside the leakage belt.

Table 19. Forest area, per stratum, Guinea Bissau (2007) according to the Second National Communication on Climate Change (UNFCCC, 2011)

Forest Type		2007 (ha)	Source
Terrestrial Forest	Closed Forest	147,865	Second National Communication on Climate Change in Guinea-Bissau (UNFCCC 2011)
	Open Forest	638,350	
	Savanna	1,582,289	
Wetlands	Mangrove	314,786	
TOTAL		2,683,290	

$$AVFOR = TOTFOR - PROTFOR - MANFOR$$

Where:

$AVFOR$ Total available national forest area for unplanned deforestation; ha

$TOTFOR$ Total available national forest area; ha

$PROTFOR$ Total are of fully protected forest nationally; ha

$MANFOR$ Total area of forest under active management nationally; ha

$$AVFOR = 2{,}683{,}290$$

[29] http://unfccc.int/resource/docs/natc/gnbnc2e.pdf

Next, the ratio of the forested area in the Leakage Belt ($PROP_{LB}$) was calculated as a proportion of the total available national forest area.

$$PROP_{LB} = {}^{LBFOR}/_{AVFOR}$$

Where:

$PROP_{LB}$ Area of forest available in the Leakage Belt for unplanned deforestation as a proportion of the total national forest area available for unplanned deforestation; proportion

$LBFOR$ Total available forest area for unplanned deforestation in the Leakage Belt; ha (BL-UP: Leakage Belt Forest Cover Map)

$AVFOR$ Total available national forest area for unplanned deforestation; ha

Table 20. LBFOR value and source

Variable	Value	Source
$LBFOR$	130,975	LK area based on WB2 - C assessment and emission baseline v2.3.xlsx

$PROP_{LB}$= 0.049

To stratify $AVFOR$, forest carbon stocks across the country and forest cover areas from the Second National Communication of Guinea-Bissau to UNFCCC (2011) were used. The document is the official communication of the Government of Guinea-Bissau to the United National Framework Convention on Climate Change regarding national GHG emissions, including those arising for land use and land cover change. The document is publically available at http://unfccc.int/resource/docs/natc/gnbnc2e.pdf. The mean aboveground live tree carbon stock outside the leakage belt ($C_{□LB}$) was calculated based on official governmental data submitted to UNFCCC. Area weighted average AGB for open forest, closed forest, savannah and mangroves were used and C_{OLB} calculated according to the table below.

Table 21. Parameters used for C_{OLB} calculation and source

<table>
<tr><th colspan="2">Forest Type</th><th>Average AGB (t/ha)</th><th>Carbon Fraction</th><th>tC/ha</th><th>Area (ha)</th><th>tCO2/ha</th><th>Source</th></tr>
<tr><td rowspan="3">Terrestrial Forest</td><td>Closed Forest</td><td>186.26</td><td>0.47</td><td>88</td><td>147,865</td><td>321</td><td rowspan="5">Second National Communication on Climate Change in Guinea-Bissau (UNFCCC 2011)</td></tr>
<tr><td>Open Forest</td><td>120.64</td><td>0.47</td><td>57</td><td>638,350</td><td>208</td></tr>
<tr><td>Savanna</td><td>27.68</td><td>0.47</td><td>13</td><td>1,582,289</td><td>48</td></tr>
<tr><td>Wetlands</td><td>Mangrove</td><td>23.82</td><td>0.47</td><td>11</td><td>314,786</td><td>41</td></tr>
<tr><td colspan="2">Total Forest</td><td></td><td></td><td></td><td>2,683,290</td><td>100.09</td></tr>
</table>

$$C_{OLB} = 100.09$$

The mean aboveground live tree carbon stock inside the leakage belt (C_{LB}) was calculated based on field data, using area weighted average AGB for open forest, closed forest, savannah and mangroves. In doing so, the AGB value applied for closed forest (306.1129 tCO_2/ha) is the one quantified for Cantanhez since this is the only data available, as this stratum was not identified in Cacheu. For all remaining stratum the average AGB were weighted considering the relative areas of each stratum in Cacheu and Cantanhez. Each value is calculated considering ((LB Area Stratum(i, Cacheu)* AGB tCO_2/ha(i, Cacheu)+ (LB Area Stratum(i, Cantanhez)* AGB tCO_2/ha(i, Cantanhez))/ ((LB Area Stratum(i, Cacheu)+(LB Area Stratum(i, Cantanhez)). All data is sourced from field data presented on the spreadsheet WB2 – C assessment and emissions baseline v2.3.xlsx and the resulting values are presented on the table below.

Table 22. Parameters used for C_{LB} calculation and source

<table>
<tr><th colspan="2">Forest Type</th><th>Area (ha)</th><th>tCO2/ha</th><th>Source</th></tr>
<tr><td rowspan="3">Terrestrial Forest</td><td>Closed Forest</td><td>8,425</td><td>306.11</td><td rowspan="5">WB2 - C assessment and emission baseline v2.3.xlsx</td></tr>
<tr><td>Open Forest</td><td>62,247</td><td>128.07</td></tr>
<tr><td>Savanna</td><td>21,970</td><td>100.77</td></tr>
<tr><td>Wetlands</td><td>Mangrove</td><td>35,927</td><td>89.55</td></tr>
<tr><td colspan="2">Total Forest</td><td>128,569</td><td>124.31</td></tr>
</table>

$$C_{LB} = 124.31$$

The proportional difference in carbon stocks between areas of forest available for unplanned deforestation both inside and outside de leakage belt ($PROP_{CS}$).

$$PROP_{CS} = {C_{OLB}}/{C_{LB}}$$

Where:

$PROP_{CS}$ The proportional difference in carbon stocks between areas of forest available for unplanned deforestation both inside and outside the leakage belt; proportion

C_{OLB} Area weighted average aboveground tree carbon stock for forest available for unplanned deforestation outside the leakage belt; $tCO_2e.ha^{-1}$

C_{LB} Area weighted average aboveground tree carbon stock for forest available for unplanned deforestation inside the leakage belt; $tCO_2e.ha^{-1}$

$$PROP_{CS} = 0.805$$

The proportional leakage for areas with immigrating populations are equal to the immigrating proportion multiplied by the proportion of available national forest area outside de Leakage Belt multiplied by the proportional difference in stocks between forests inside and outside the Leakage Belt and was calculated according to equation 5 of LK-ASU Module.

$$\mathrm{LK_{PROP}} = \mathrm{PROP_{IMM}} * (1 - \mathrm{PROP_{LB}}) * \mathrm{PROP_{CS}}$$

Where:

$\mathrm{LK_{PROP}}$ Proportional leakage for areas with immigrating population; proportion

$\mathrm{PROP_{IMM}}$ Estimated proportion of baseline deforestation caused by immigrating population; proportion

$\mathrm{PROP_{LB}}$ Area of forest available in the Leakage Belt for unplanned deforestation as a proportion of the total national forest area available for unplanned deforestation; proportion

$\mathrm{PROP_{CS}}$ The proportional difference in carbon stocks between areas of forest available for unplanned deforestation both inside and outside the leakage belt; proportion

$$\mathrm{LK_{PROP}} = 0.071$$

The net leakage outside the Leakage Belt ($\Delta C_{LK\text{-}AS,OLB}$) is calculated below:

$$\Delta \mathrm{C_{LK-ASU,OLB}} = \left(\Delta \mathrm{C_{BSL,LK,unplanned}} - \Delta \mathrm{C_{P,LB}}\right) * \mathrm{LK_{PROP}}$$

Where:

$\Delta \mathrm{C_{LK-ASU,OLB}}$ Net CO_2 emissions due to unplanned deforestation displaced outside the leakage belt; tCO_2e

$\Delta \mathrm{C_{BSL,LK,unplanned}}$ Net CO_2 emissions in the baseline form unplanned deforestation in the leakage belt; tCO_2e

$\Delta C_{P,LB}$ Net GHG emissions within the leakage belt in the project case; tCO_2e. Ex-ante estimate calculated based on a 20% emissions displacement factor from the project area to the leakage belt. This result is added to the estimated baseline for the leakage belt.

LK_{PROP} Proportional leakage for areas with immigrating population; proportion

Table 23. Ex ante estimation of net CO_2 emissions due to unplanned deforestation displaced outside the Leakage Belt

Years	$\Delta C_{BSL,LK,unplanned}$	$\Delta C_{P,LB}$	LK_{PROP}	$\Delta C_{LK-ASU,OLB}$
2013	94,810	113,974	0.071	1,365
2014	193,779	232,958	0.071	2,791
2015	296,909	356,952	0.071	4,277
2016	404,198	485,957	0.071	5,824
2017	515,647	619,973	0.071	7,431
2018	631,255	758,999	0.071	9,099
2019	751,024	903,036	0.071	10,828
2020	874,952	1,052,083	0.071	12,617
2021	1,003,040	1,206,141	0.071	14,467
2022	1,135,288	1,365,210	0.071	16,377
2023	1,230,098	1,479,183	0.071	17,742
2024	1,329,068	1,598,167	0.071	19,168
2025	1,432,197	1,722,162	0.071	20,654
2026	1,539,486	1,851,167	0.071	22,201
2027	1,650,935	1,985,183	0.071	23,808
2028	1,766,544	2,124,209	0.071	25,476
2029	1,886,312	2,268,246	0.071	27,205
2030	2,010,241	2,417,293	0.071	28,994
2031	2,138,329	2,571,351	0.071	30,844
2032	2,270,576	2,730,419	0.071	32,754
Total	23,154,687	27,842,663		333,919

Total leakage due to displacement of unplanned deforestation is presented below applying equation 13 from LK-ASU Module. As previously discussed, it is not anticipated any emissions arising from leakage prevention activities.

$$\Delta C_{LK-AS,unplanned} = \Delta C_{LK-ASU-LB} + \Delta C_{LK-ASU,OLB} + GHG_{LK,E}$$

Where:

$\Delta C_{LK-AS,unplanned}$	Net greenhouse gas emissions due to activity shifting leakage for projects preventing unplanned deforestation net CO_2 emissions; tCO_2e
$\Delta C_{LK-ASU-LB}$	Net CO_2 emissions due to unplanned deforestation displaced from the project area to the leakage belt; tCO_2e
$\Delta C_{LK-ASU,OLB}$	Net CO_2 emissions due to unplanned deforestation displaced outside the leakage belt; tCO_2e
$GHG_{LK,E}$	Greenhouse gas emissions as a result of leakage of avoided deforestation activities; tCO_2e

Table 24. Calculation of the total leakage due to the displacement of unplanned deforestation

Years	$\Delta C_{LK-ASU-LB}$	$\Delta C_{LK-ASU,OLB}$	$GHG_{LK,E}$	$\Delta C_{LK-AS,unplanned}$
2013	19,164	1,365	0	20,529
2014	39,178	2,791	0	41,969
2015	60,044	4,277	0	64,320
2016	81,760	5,824	0	87,583
2017	104,326	7,431	0	111,757
2018	127,744	9,099	0	136,843
2019	152,012	10,828	0	162,840
2020	177,131	12,617	0	189,748
2021	203,101	14,467	0	217,568
2022	229,921	16,377	0	246,298
2023	249,085	17,742	0	266,827
2024	269,100	19,168	0	288,267
2025	289,965	20,654	0	310,619
2026	311,681	22,201	0	333,882
2027	334,248	23,808	0	358,056
2028	357,665	25,476	0	383,141
2029	381,933	27,205	0	409,138
2030	407,052	28,994	0	436,046
2031	433,022	30,844	0	463,866
2032	459,843	32,754	0	492,597
Total	4,687,975	333,919	0	5,021,894

3.4 Net GHG Emission Reductions and Removals

The total net greenhouse gas emissions reductions of the REDD project activity are calculated as follows (Equation 1 of REDD-MF):

$$C_{REDD,t} = \Delta C_{BSL} - \Delta C_{P} - \Delta C_{LK}$$

Where:

$C_{REDD,t}$	Total net greenhouse emission reduction at time t; tCO_2e
ΔC_{BSL}	Net greenhouse gas emission under the baseline scenario; tCO_2e
ΔC_{P}	Net greenhouse gas emission within the project area under the project scenario; tCO_2e (Section 3.2)
ΔC_{LK}	Net greenhouse gas emission due to leakage; tCO_2e

The net greenhouse gas emissions under the baseline scenario (ΔC_{BSL}) are the emissions in the baseline from unplanned deforestation ($\Delta C_{BSL,unplanned}$) demonstrated in Section 3.1 and derived from module BL-UP. The annual baseline emissions for the first 20 years crediting period are presented in the tables below. Since the project calculated baseline emissions separately for each Project Area (i.e. Cacheu and Cantanhez) the values are presented individually. For the net GHG emissions reductions and removal calculation the values are aggregated and each values combined summing up baseline emission in Cacheu and Cantanhez. Table 25 depicts the sum of the net GHG baseline emissions on Cacheu and Cantanhez, for example, in 2013 the value 95,819 is the round up of the sum of 20,232.41 (Cacheu) and 75,586.43 (Cantanhez).

		2013	2014	2015	2016	2017
Cacheu	ΔCBSL,PA,unplanned (tCO2-e)	20,232	41,454	63,666	86,866	111,056
	ΔCBSL,unplanned (tCO2-e)	20,232	41,454	63,666	86,866	111,056
Cantanhez	ΔCBSL,PA,unplanned (tCO2-e)	75,586	154,437	236,552	321,932	410,575
	ΔCBSL,unplanned (tCO2-e)	75,586	154,437	236,552	321,932	410,575

		2018	2019	2020	2021	2022
Cacheu	ΔCBSL,PA,unplanned (tCO2-e)	136,236	162,405	189,563	217,711	246,849
	ΔCBSL,unplanned (tCO2-e)	136,236	162,405	189,563	217,711	246,849
Cantanhez	ΔCBSL,PA,unplanned (tCO2-e)	502,483	597,655	696,092	797,793	902,758
	ΔCBSL,unplanned (tCO2-e)	502,483	597,655	696,092	797,793	902,758

		2023	2024	2025	2026	2027
Cacheu	ΔCBSL,PA,unplanned (tCO2-e)	267,081	288,303	310,514	333,715	357,905
	ΔCBSL,unplanned (tCO2-e)	267,081	288,303	310,514	333,715	357,905
Cantanhez	ΔCBSL,PA,unplanned (tCO2-e)	978,345	1,057,195	1,139,310	1,224,690	1,313,333
	ΔCBSL,unplanned (tCO2-e)	978,345	1,057,195	1,139,310	1,224,690	1,313,333

		2028	2029	2030	2031	2032
Cacheu	ΔCBSL,PA,unplanned (tCO2-e)	383,085	409,254	436,412	464,560	493,697
	ΔCBSL,unplanned (tCO2-e)	383,085	409,254	436,412	464,560	493,697
Cantanhez	ΔCBSL,PA,unplanned (tCO2-e)	1,405,241	1,500,414	1,598,850	1,700,551	1,805,516
	ΔCBSL,unplanned (tCO2-e)	1,405,241	1,500,414	1,598,850	1,700,551	1,805,516

The same calculation is performed for every year for the first crediting period, between 2013 and 2032. As discussed on Section 3.2, net greenhouse gas emissions within the project area under the project scenario (ΔC_P) is considered zero for ex-ante quantification purpose.

Net greenhouse gas emissions due to leakage (ΔC_{LK}) were calculated for each year in the first crediting period and detailed on Section 3.3 (see Table 24). Therefore, for every year, the Baseline Emissions was calculated summing the baseline emissions for Cacheu and Cantanhez (as shown above). From this value project emissions and leakage emissions were subtracted. Since estimated project emission for ex-ante calculations is considered zero only leakage emissions are subtracted. Table 25 presents the estimated net GHG emissions reduction and removals due to the project activity between 2013 and 2032. For 2013, for example:

$$C_{REDD,2013} = \Delta C_{BSL,2013} - \Delta C_{P,2013} - \Delta C_{LK,2013}$$

$$C_{REDD,2013} = 95{,}819 - 0 - 20{,}529$$

$$C_{REDD,2013} = 75{,}290 \text{ tCO}_2\text{e}$$

The expected net GHG emissions reduction or removals in the first crediting period totals 18,417,983 tCO_2e.

Table 25. Estimated net GHG emissions reduction or removals (tCO_2e)

Years	Estimated baseline emissions or removals (tCO2e)	Estimated project emissions or removals (tCO2e)	Estimated leakage emissions (tCO2e)	Estimated net GHG emission reductions or removals (tCO2e)
2013	95,819	0	20,529	75,290
2014	195,891	0	41,969	153,923
2015	300,218	0	64,320	235,897
2016	408,798	0	87,583	321,215
2017	521,632	0	111,757	409,874
2018	638,719	0	136,843	501,876
2019	760,061	0	162,840	597,221
2020	885,656	0	189,748	695,908
2021	1,015,504	0	217,568	797,937
2022	1,149,607	0	246,298	903,308
2023	1,245,426	0	266,827	978,599
2024	1,345,498	0	288,267	1,057,231
2025	1,449,825	0	310,619	1,139,206
2026	1,558,405	0	333,882	1,224,523
2027	1,671,239	0	358,056	1,313,183
2028	1,788,326	0	383,141	1,405,185
2029	1,909,667	0	409,138	1,500,529
2030	2,035,262	0	436,046	1,599,216
2031	2,165,111	0	463,866	1,701,245
2032	2,299,214	0	492,597	1,806,617
Total	23,439,877	0	5,021,894	18,417,983

3.4.1 Estimation of VCS buffer

In AFOLU projects there is a stock permanence risk. In other words, a GHG reduction in a given year can be turned into an emission in case, for example, of fire or in the events of natural disturbance. To mitigate such risks, the VCS established that a crediting buffer must be established and a percentage of the VCU withhold considering an specific project risk. The number of credits to be held in the permanence risk buffer is determined as a percentage of the total carbon stock benefits. The percentage is calculated following the module T-BAR. The detailed risk report is presented on Appendix I of this PD.

The VCS Buffer is equal to the net emissions in the baseline minus project emissions derived from fossil fuels use and fertilizers use multiplied by the risk factor resulting from T-BAR (see Appendix I). Leakage emissions do not factor into the buffer calculations. As discussed, the project does not expect emissions from fossil fuel use or fertilizer application; hence, the buffer equation was simplified as follows (Equation 5 of REDD-MF):

$$\text{Buffer}_{\text{unplanned}} = \left(\Delta C_{\text{BSL,unplanned}} - \Delta C_{\text{P}}\right) * \text{Buffer\%}$$

Where:

$\text{Buffer}_{\text{unplanned}}$	Buffer withholding for unplanned deforestation project areas; tCO_2e
$\Delta C_{\text{BSL,unplanned}}$	Net greenhouse gas emissions in the baseline from unplanned deforestation; tCO_2e
ΔC_{P}	Net greenhouse gas emissions within the project area under the project scenario; tCO_2e
$\text{Buffer\%}$	Buffer withholding percentage; %. Calculated according to T-BAR, for details see Appendix I of the PD. (0.10)

According to the Risk Report, the project totals 6 points in the non-permanence risk analysis. Since the minimum risk scoring allowed is 10, a value of 10 was applied to the project (10% or 0.10). The next table details the calculation. It is important to notice, as said, that the buffer account does not consider leakage emissions, therefore, the 10% risk buffer is derived only from the estimated baseline emissions presented on Table 25. Using the same example as before for year 2013, the sum of the baseline emissions in Cacheu and Cantanhez in 2013 totaled 95,819. Hence, the 10% buffer value is 9,582 as shown below:

$$\text{Buffer}_{\text{unplanned,2013}} = \left(\Delta C_{\text{BSL,unplanned,2013}} - \Delta C_{\text{P,2013}}\right) * \text{Buffer\%}$$

$$\text{Buffer}_{\text{unplanned,2013}} = (95{,}819 - 0) * 0.10$$

$$\text{Buffer}_{\text{unplanned,2013}} = 95{,}819 * 0.10$$

$$\text{Buffer}_{\text{unplanned,2013}} = 9{,}582$$

Uncertainty analysis was conducted to provide conservative estimates of the total net GHG emission reduction according to module X-UNC version 2.0. Total uncertainty in the baseline scenario summed 13% for Cacheu and 9% for Cantanhez at the 95% confidence interval. According to the module, the allowable uncertainty under the REDD-MF methodology is +/-15% of $C_{REDD,t}$ at the 95% confidence interval. Since the uncertainty level is attained no deduction is performed. The estimate number of Verified Carbon Units (VCUs) for the monitoring period $T=t_2-t_1$ is performed according to Equation 8 of REDD-MF.

$$\text{VCU}_{\text{t}} = \left(\text{Adjusted\_C}_{\text{REDD,t2}} - \text{Adjusted\_C}_{\text{REDD,t1}}\right) - \text{Buffer}_{\text{TOTAL}}$$

Where:

VCU_{t}	Number of Verified Carbon Units at time $t=t_2-t_1$; VCU

$\text{Adjusted\_C}_{\text{REDD,t2}}$	Cumulative total net GHG emissions reductions at time t_2 adjusted to account for uncertainty; tCO_2e
$\text{Adjusted\_C}_{\text{REDD,t1}}$	Cumulative total net GHG emissions reductions at time t_1 adjusted to account for uncertainty; tCO_2e
$\text{Buffer}_{\text{TOTAL}}$	Total permanence risk buffer withholding; tCO_2e

An example calculation is presented for the year 2014:

$$\text{VCU}_{2014} = \left(\text{Adjusted\_C}_{\text{REDD,2014}} - \text{Adjusted\_C}_{\text{REDD,2013}}\right) - \text{Buffer}_{\text{TOTAL,2014}}$$

$$\text{VCU}_{2014} = 153{,}923 - 19{,}589$$

$$\text{VCU}_{2014} = 134{,}333$$

The table below present the calculation performed for each year in the first crediting period.

Years	Estimated net GHG emission reductions or removals (tCO_2e)	Risk buffer	Deductions for AFOLU pooled buffer account	Net Total (tCO_2e)
2013	75,290	10%	9,582	65,708
2014	153,923	10%	19,589	134,333
2015	235,897	10%	30,022	205,876
2016	321,215	10%	40,880	280,335
2017	409,874	10%	52,163	357,711
2018	501,876	10%	63,872	438,004
2019	597,221	10%	76,006	521,215
2020	695,908	10%	88,566	607,342
2021	797,937	10%	101,550	696,386
2022	903,308	10%	114,961	788,348
2023	978,599	10%	124,543	854,056
2024	1,057,231	10%	134,550	922,681
2025	1,139,206	10%	144,982	994,223
2026	1,224,523	10%	155,840	1,068,683
2027	1,313,183	10%	167,124	1,146,059
2028	1,405,185	10%	178,833	1,226,352
2029	1,500,529	10%	190,967	1,309,563
2030	1,599,216	10%	203,526	1,395,690
2031	1,701,245	10%	216,511	1,484,734
2032	1,806,617	10%	229,921	1,576,696
Total	18,417,983	10%	2,343,988	16,073,995

3.4.2 Uncertainty analysis

As discussed, total uncertainty was calculated according to (X-UNC) for the aboveground and belowground biomass tree pools. Both in Cantanhez and Cacheu the variation was within the 15% (CI 95%) confidence level and no adjustment had to be made.

4 MONITORING

This section presents the monitoring methodology for changes in the forest cover and carbon stock changes. All relevant parameters of the monitoring plan, according to M-MON, are included and detailed in this section. The monitoring plan includes the periodic revision of: (i) the baseline, (ii) the changes in actual carbon stock and associated GHG emissions, (iii) the eventual leakage and associated GHG emissions and (iv) the ex-post net carbon stock changes and GHG emissions.

Revision of the baseline

The baseline shall be revised every 10 years from the project start date because agents, drivers and underlying causes of deforestation change dynamically. The methodological procedure used to update the baseline shall be the same as used in the definition of the baseline according to this PD. The objective of the revision of the baseline is to evaluate any significant changes in the deforestation trends in the Reference Region

The technical description of the monitoring task is presented in Section 4.3. Section 4.2 presents all data to be collected, including procedures, quality control and quality assurance (QC/QA) and data archiving.

Monitoring of actual carbon stock changes and greenhouse gas emissions

The monitoring of actual carbon stock changes and GHG emissions is necessary to evaluate the actual efficiency of the project in reducing deforestation. Monitoring of the forest cover and the carbon stocks in the project area will be performed and associated GHG emissions calculated.

The technical description of the monitoring task is presented in Section 4.3. Section 4.2 presents all data to be collected, including procedures, quality control and quality assurance (QC/QA) and data archiving

Monitoring of leakage carbon stock changes and greenhouse gas emissions

The monitoring of leakage emissions will be performed through the evaluation of forest cover changes due to the displacement of deforestation activities from the project area to the leakage belt. Monitoring of Leakage Belt will be performed and associated GHG emissions calculated.

The technical description of the monitoring task is presented in Section 4.3. Section 4.2 presents all data to be collected, including procedures, quality control and quality assurance (QC/QA) and data archiving

Estimation of ex-post net carbon stock changes and greenhouse gas emissions.

The monitoring of the actual carbon stock changes and the leakage emissions will allow the estimation of the ex-post net carbon stock changes and associated GHG emission reduction.

The technical description of the monitoring task is presented in Section 4.3. Section 4.2 presents all data to be collected, including procedures, quality control and quality assurance (QC/QA) and data archiving

Organization and responsibilities of the parties involved in all the above.

The Institute for Biodiversity and Protected Areas (IBAP) of Guinea-Bissau is the organization responsible for the monitoring of the project.

4.1 Data and Parameters Available at Validation

Data / Parameter	CF
Data unit	tC t^{-1} d.m.
Description	Carbon fraction of dry matter
Source of data	IPCC 2006 Ch.4 Table 4.3
Value applied:	Default value 0.47 t C t-1 d.m.
Justification of choice of data or description of measurement methods and procedures applied	IPCC is a peer-reviewed source widely used for GHG quantification.
Purpose of Data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Comments	Default values shall be updated whenever new guidelines are produced by the IPCC.

Data / Parameter	$COMF_i$
Data unit	Dimensionless
Description	Combustion factor for stratum i (vegetation type)
Source of data	Default values IPCC 2006 Ch.2 Table 2.6
Value applied:	Closed Forest - 0.32 Open Forest - 0.45

	Savanna - 0.72 Mangrove - 0.36
Justification of choice of data or description of measurement methods and procedures applied	IPCC is a peer-reviewed source widely used for GHG quantification. The choice of values applied to each stratum considers climatic and ecological classifications defined by IPCC. Table 2.6 presents values for Closed Forest, Open Forest and Savanna. For mangrove the classification of "all primary tropical forests" is used since no specific value is presented.
Purpose of Data	• Calculation of project emissions
Comments	The combustion factor is a measure of the proportion of the fuel that is actually combusted, which varies as a function of the size and architecture of the fuel load, the moisture content of the fuel and the type of fire. Default values shall be updated whenever new guidelines are produced by the IPCC.

Data / Parameter	G_{gi}
Data unit	g kg^{-1} dry matter burnt
Description	Emission factor for stratum i for gas g
Source of data	Default values IPCC 2006 Ch.2 Table 2.5
Value applied:	Closed Forest: CH_4 – 6.8 and N_2O – 0.20 Open Forest: CH_4 – 6.80 and N_2O – 0.20 Savanna: CH_4 – 2.30 and N_2O – 0.21 Mangrove: CH_4 – 4.7 and N_2O – 0.26
Justification of choice of data or description of measurement methods and procedures applied	IPCC is a peer-reviewed source widely used for GHG quantification. The choice of values applied to each stratum considers climatic and ecological classifications defined by IPCC. Table 2.5 presents values for Tropical Forest, used for Closed Forest and Open Forest, and Savanna. For mangrove the classification of "extra tropical forests" is used since no specific value is presented and the table recommends this category be used for all other forest type.
Purpose of Data	• Calculation of project emissions
Comments	Default values shall be updated whenever new guidelines are produced by the IPCC

Data / Parameter	D_j
Data unit	t d.m. m^3
Description	Basic wood density in t d.m m^3 for species j

Source of data	Data is source from a combination of literature ranging from (a) national species-specific or group of species-specific, from CARBOVEG-GB, (b) species-specific or groups of species from neighboring countries with similar conditions, from Brown (1997), Nygard & Elfying (2000) and Reyes et al. (1992), and (c) global species-specific or group of species-specific, from IPCC (2006) and the Global Wood Density Database. When known, species-specific wood density was applied. When the species was not known or wood density values were not published/available, an average wood density was calculated from the data collected under CARBOVEG-GB and applied (0.731 g cm^3)
Value applied:	See Appendix 2 – Wood Density Information
Justification of choice of data or description of measurement methods and procedures applied	Data sources comply with the requirements of M-MON and all values are referenced on Appendix 2 – Wood Density Information. When reference is made to CARBOVEG-GB, measurements were undertaken by IICT on three different periods: 2007, 2009 and 2012. The methods and procedures applied are the same described on section 4.3.4 and follow the protocols and requirements established by the modules CP-AB and X-STR.
Purpose of Data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Comments	Not applicable

Data / Parameter	f_{palm} (X,Y)
Data unit	t d.m. $tree^{-1}$
Description	Allometric equation for palm species linking measured tree variable(s) to aboveground biomass of living trees.
Source of data	Delaney, S. and Powell, M. (1999) 1999 Carbon-Offset Report for the Noel Kempff Climate Action Project, Bolivia. Reporto to the Nature Conservancy. Winrock International, Arlington, VA, USA. The reference is listed both in IPCC GPG-LULUCF (2003) and Pearson et al. (2005)
Value applied:	$AGB_{palm} = 6.666 + 12.826 * H^{0.5} * \ln H$
Justification of choice of data or description of measurement methods and procedures applied	Delaney et al. (1999) complies with M-MON requirements being built on a sample of n=30 and a deviation was approved since r^2 = 0.75 but conservativeness was demonstrating by comparing Delaney et al. (1999) equation with other equations available in the literature. The equation is a allometric equation for mangroves requiring only one parameter (height). The equation is a (e) pan-

	tropical forest type-specific.
Purpose of Data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Comments	The deviation was approved and the equation validated based on a sample of 30 palms (Elaeis guineensis) in Guinea Bissau measured in February 2013.

Data / Parameter	R
Data unit	t root d.m. t^{-1} shoot d.m.
Description	Root to shoot ratio appropriate to species or forest type / biome applied as belowground biomass per unit area
Source of data	Mokany et al. (2006) for tropical dry forest (IPCC 2006 Ch.4 Table 4.4) Komyiama et al. (2008) for mangrove
Value applied:	For tropical dry forest: • if AGB < 20 $t.ha^{-1}$ R=0.56; • if AGB > 20 $t.ha^{-1}$ R=0.28 For mangrove forest R=0.46
Justification of choice of data or description of measurement methods and procedures applied	The data applied for terrestrial forests are (b) globally forest type-specific or eco-region-specific sourced from IPCC 2006. IPCC is a peer-reviewed source widely used for GHG quantification. For mangroves, data reported in Komyiama et al. (2006) were averaged and resulted in a RSR value of 0.61. Conservatively, the half-width of the 95% confidence interval of these data was used to estimate the applied RSR (0.46).
Purpose of Data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Comments	Not applicable

4.2 Data and Parameters Monitored

Data / Parameter	C_{OLB}
Data unit	$tCO_2e\ ha^{-1}$
Description	Area weighted average aboveground tree carbon stock for forests available for unplanned deforestation outside the Leakage Belt
Source of data	Second National Communication on Climate Change in Guinea-Bissau (UNFCCC, 2011)

Description of measurement methods and procedures to be applied	• Methods and procedures: Data from (i) aboveground tree carbon stock of forests outside the leakage belt and (ii) forest cover areas must be weight averaged ($tCO_2e\ ha^{-1}$). Detailed calculation methods of carbon stocks are presented on Section 4.3.4. • Entity responsible for the measurement: IBAP • Accuracy: for the delineation of forest area (ha) the minimum map accuracy must be 90% for the classification of the forest/non-forest in the remote sensing imagery. For carbon stocks see Section 4.3.4. If peer-reviwed data is applied, calculation methods and procedures are not applicable. Accuracy will be depedent on quality of available data.
Frequency of monitoring/recording	The area-weighted average must be recalculated at least every 5 years.
Value applied:	100.09
Monitoring equipment	If field measurement is performed, data collection must be in accordance with module CP-AB. The following monitoring equipments shall be used: • Diametric tape; • Hypsometer; • GPS; • Digital Camera; • Remote sensing data; • Computer, GIS software and spreadsheets. If peer-reviwed data is applied, monitoring equipments are not applicable.
QA/QC procedures to be applied	If field measurement is performed, standard QA/QC assurance procedures for forest inventory, including field data collection and data management shall be applied. All data registry must be backed up and stored in diferent sources (physical and digital) and midias (HDs, serves, internet cloud). See the Monitoring Plan for detailed QA/QC procedures (Section 4.3)
Purpose of data	• Calculation of leakage
Calculation method	Either: • Calculate directly from field measurement; OR • Use numbers derived from peer-reviewed literature that are nationally or at least regionally appropriate.
Comments	For ex-ante GHG emissions reduction quantification, data from forest area and stratum carbon content is derived from the official

	governmental communication on Climate Change in Guinea-Bissau to the United National Framework Convention on Climate Change (UNFCCC).

Data / Parameter	C_{LB}
Data unit	$tCO_2e\ ha^{-1}$
Description	Area weighted average aboveground tree carbon stock for forests available for unplanned deforestation inside the Leakage Belt
Source of data	Derived from field work measurement (Carbon Stock) performed for the baseline establishment (Winrock/IICT 2012) and on remote sensing using Landsat imagery (Stratum Area) in combination with GPS data collected during ground truthing (Winrock/IICT 2012)
Description of measurement methods and procedures to be applied	• Methods and procedures: calculated from field measurement using modules CP-AB, BL-UP and X-STR. On each monitoring period forest cover changes must be quantified using map algebra and a new area weighted average aboveground carbon stock for forest inside the leakage belt recalculated. Detailed calculation methods of carbon stocks are presented on Section 4.3.4. • Entity responsible for the measurement: IBAP • Accuracy: for the delineation of forest area (ha) the minimum map accuracy must be 90% for the classification of the forest/non-forest in the remote sensing imagery. For carbon stocks see Section 4.3.4.
Frequency of monitoring/recording	Must be recalculated at each monitoring period.
Value applied:	124.31
Monitoring equipment	The following monitoring equipments shall be used: • Diametric tape; • Hypsometer; • GPS; • Digital Camera; • Remote sensing data; • Computer, GIS software and spreadsheets.
QA/QC procedures to be applied	Standard QA/QC assurance procedures for forest inventory, including field data collection and data management shall be applied. All data registry must be backed up and stored in diferent sources (physical and digital) and midias (HDs, serves, internet cloud). See the Monitoring Plan for detailed QA/QC procedures (Section 4.3). If map classification accuracy is less than 90% then the map is not

	acceptable for further analysis. More remote sensing data and ground truthing data will be needed to produce a product that reaches the 90% minimum mapping accuracy.
Purpose of data	• Calculation of leakage
Calculation method	Calculate directly from field measurement and map algebra.
Comments	As forests in the leakage belt are deforested, the area-weighted average must be recalculated at each monitoring period.

Data / Parameter	MANFOR
Data unit	ha
Description	Total area of forest under active management nationally
Source of data	Official data, peer reviewed publication and other verifiable sources
Description of measurement methods and procedures to be applied	• Methods and procedures: identify available data on the total area of forest under active management from official data or peer-reviewed publication. • Entity responsible for the measurement: IBAP • Accuracy: subject to the quality of the data available, for example, protected area boundaries provided by the government
Frequency of monitoring/recording	Must be monitored at least every 5 years or if verification occurs in a frequency of less than every 5 years examination must occur prior to any verification event
Value applied:	0
Monitoring equipment	Not applicable
QA/QC procedures to be applied	Broader evaluation must be carried out so the most up-to-date information is used.
Purpose of data	• Calculation of leakage
Calculation method	Sourced from literature
Comments	For ex-ante quantification MANFOR was considered conservatively as zero.

Data / Parameter	$PROP_{IMM}$
Data unit	Proportion
Description	Estimated proportion of baseline deforestation caused by immigrating population
Source of data	PRA, peer-reviewed literature or official governmental data
Description of	• Methods and procedures: identify and collect available data

measurement methods and procedures to be applied	on the proportion of immigrants • Entity responsible for the measurement: IBAP • Accuracy: subject to the quality of the data available. When using a PRA, sampling must be carried on and around the project area and within 2 km from the leakage belt
Frequency of monitoring/recording	Must be monitored at least every 5 years or if verification occurs in a frequency of less than every 5 years examination must occur prior to any verification event
Value applied:	0.093
Monitoring equipment	The following monitoring equipments shall be used to perform the PRA: • Notebooks, field sheets, tablets; • GPS; • Digital Camera; • Spreadsheets.
QA/QC procedures to be applied	When the proportion of immigrants is calculated using a PRA all data must be documented and stored. The field team interviewing the communities must be properly trained.
Purpose of data	• Calculation of leakage
Calculation method	Semi structured research applied to communities living inside and around the Project Area
Comments	Not applicable

Data / Parameter	$PROP_{RES}$
Data unit	Proportion
Description	Estimated proportion o baseline deforestation caused by population that has been resident for more than 5 years
Source of data	PRA, peer-reviewed literature or official governmental data
Description of measurement methods and procedures to be applied	• Methods and procedures: identify and collect available data on the proportion of immigrants • Entity responsible for the measurement: IBAP • Accuracy: subject to the quality of the data available. When using a PRA, sampling must be carried on and around the project area and within 2 km from the leakage belt
Frequency of monitoring/recording	Must be monitored at least every 5 years or if verification occurs in a frequency of less than every 5 years examination must occur prior to any verification event
Value applied:	0.907
Monitoring equipment	The following monitoring equipments shall be used to perform the

	PRA: • Notebooks, field sheets, tablets; • GPS; • Digital Camera; • Spreadsheets.
QA/QC procedures to be applied	When the proportion of residents is calculated using a PRA all data must be documented and stored. The field team interviewing the communities must be properly trained.
Purpose of data	• Calculation of leakage
Calculation method	Semi structured research applied to communities living inside and around the Project Area
Comments	Not applicable

Data / Parameter	PROTFOR
Data unit	ha
Description	Total area of fully protected forest nationally
Source of data	Official data, peer reviewed publication and other verifiable sources
Description of measurement methods and procedures to be applied	• Methods and procedures: identify available data on the total area of forest under active management from official data or peer-reviewed publication. In Guinea-Bissau the total area of forest under protection is equal to the area of the National System of Protected Areas (SNAP). • Entity responsible for the measurement: IBAP • Accuracy: subject to the quality of the data available, for example, protected area boundaries provided by the government
Frequency of monitoring/recording	Must be monitored at least every 5 years or if verification occurs in a frequency of less than every 5 years examination must occur prior to any verification event
Value applied:	0
Monitoring equipment	Not applicable
QA/QC procedures to be applied	Broader evaluation must be carried so the must up-to-date information is used. A good cross check is the official information provided by the legal decrees that established each protected area
Purpose of data	• Calculation of leakage
Calculation method	Sourced from literature or from legal documents (i.e decrees that establish national parks)

Comments	For ex-ante quantification MANFOR was considered conservatively as zero.

Data / Parameter	TOTFOR
Data unit	ha
Description	Total available national forest area
Source of data	Official data, peer reviewed publications, remotely sensed imagery or cadastral maps and other verifiable sources
Description of measurement methods and procedures to be applied	• Methods and procedures: identify and collect available data on the total available national forest area • Entity responsible for the measurement: IBAP • Accuracy: subject to the quality of the data available.
Frequency of monitoring/recording	Must be monitored at least every 5 years or if verification occurs in a frequency of less than every 5 years examination must occur prior to any verification event
Value applied:	2,683,290
Monitoring equipment	If remotely sensed imagery, the following monitoring equipments shall be used: • Remote sensing data; • Computer, GIS software and spreadsheets.
QA/QC procedures to be applied	Broader evaluation must be carried so the must up-to-date information is used. If maps are produced and map accuracy is less than 90% then the map is not acceptable for further analysis. More remote sensing data and ground truthing data will be needed to produce a product that reaches the 90% minimum mapping accuracy.
Purpose of data	• Calculation of leakage
Calculation method	Sourced from literature or classification of remotely sensed imagery.
Comments	For ex-ante quantification degradation is considered zero

Data / Parameter	$f_{terrestrial\_forest}$ (X,Y)
Data unit	t d.m. tree^{-1}
Description	Allometric equation for terrestrial forest species linking measured tree variable(s) to aboveground biomass of living trees. This equation is used to estimate biomass of all forest tree species excluding palm trees and mangrove trees.
Source of data	Chave et al. (2005). Tree allometry and improved estimation of

	carbon stocks and balance in tropical forests. Oecologia 145, 87-89
Description of measurement methods and procedures to be applied	• Methods and procedures: For terrestrial forest three measured variables are applied: DBH, wood density and Height. For detailed methods and procedures on carbon stock quantification using the proposed allometric equation, including the measurement of DBH and Height, see Section 4.3.4. Wood density is sourced from peer-reviewed literature. • Entity responsible for the measurement: IBAP • Accuracy: should be validade according to CP-AB. Accuracy also subjected to the implied error in the allometric equation applied. Chave et al. (2005) complies with M-MON requirements being built on a sample of n=316 and $r^2 = 0.99$.
Frequency of monitoring/recording	Must be re-validated whenever biomass stocks are re-measured (at least every 10 years).
Value applied:	$AGB_{terrestrial\_forest} = 0.112^* (\rho^* DBH^2 * H)^{0.916}$
Monitoring equipment	Not applicable
QA/QC procedures to be applied	Should be validated according to module CP-AB. If the equation is not validated new data should be collected to validate the equation or a new equation should be selected. Detailed procedures are available at Pearson, T. et al. (2005) Sourcebook for Land Use, Land-Use Change and Forestry Project. Winrock International and the World Bank Biocarbon Fund.
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Calculation method	The equation is a common allometric equation for dry forest requiring three parameters (DBH, wood density and height). The equation is a (e) pan-tropical forest type-specific. For detailed calculation methods see Section 4.3.4.
Comments	A deviation was approved allowing the allometric equation to be validated after the project validation but prior to verification. A Corrective Action Plan (CAP) was prepared detailing the methods and procedures for the field data collection and demonstrating that the equation is conservative for ex-ante quantification.

Data / Parameter	$f_{mangrove}$ (X,Y)
Data unit	t d.m. tree^{-1}
Description	Allometric equation for mangrove species linking measured tree

	variable(s) to aboveground biomass of living trees.
Source of data	Chave et al. (2005). Tree allometry and improved estimation of carbon stocks and balance in tropical forests. Oecologia 145, 87-89
Description of measurement methods and procedures to be applied	• Methods and procedures: For mangrove forest two measured variables are applied: DBH and wood density. For detailed methods and procedures on carbon stock quantification using the proposed allometric equation, including the measurement of DBH, see Section 4.3.4. Wood density is sourced from peer-reviewed literature. • Entity responsible for the measurement: IBAP • Accuracy: should be validade according to CP-AB. Accuracy also subjected to the implied error in the allometric equation applied. Chave et al. (2005) complies with M-MON requirements being built on a sample of n=84 and $r^2 = 0.99$.
Frequency of monitoring/recording	Must be re-validated whenever biomass stocks are re-measured (at least every 10 years).
Value applied:	$AGB_{mongrove} = 0.168 * \rho * DBH^{2.47}$
Monitoring equipment	Not applicable
QA/QC procedures to be applied	Should be validated according to module CP-AB. If the equation is not validated new data should be collected to validate the equation or a new equation should be selected. Detailed procedures are available at Pearson, T. et al. (2005) Sourcebook for Land Use, Land-Use Change and Forestry Project. Winrock International and the World Bank Biocarbon Fund.
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Calculation method	The equation is a common allometric equation for mangroves requiring only two parameters (DBH and wood density). The equation is a (e) pan-tropical forest type-specific. For detailed calculation methods see Section 4.3.4.
Comments	A deviation was approved allowing the allometric equation to be validated after the project validation but prior to verification. A Corrective Action Plan (CAP) was prepared detailing the methods and procedures for the field data collection and demonstrating that the equation is conservative for ex-ante quantification.

Data / Parameter	$A_{RRD,unplanned,hrp}$
Data unit	ha

Description	Total area deforested during the historical reference period in the RRD
Source of data	Remote sensing using Landsat imagery from 2002, 2007 and 2010 in combination with GPS data collected during ground truthing
Description of measurement methods and procedures to be applied	• Methods and procedures: mid-resolution satellite imagery, like Landsat, is the most commonly data source used for land cover classification and land cover change analysis in large areas. Pre-processed Landsat images are used in a mapping operation that follows a three-step approach: preprocessing, classification, and validation. The preprocessing included geometric corrections, radiometric calibration, and gap fill for the 2010 images. The gap fill methodology by Scaramuzza et al. (2004) was applied to the 2010 images affected by the malfunctioning of the Scan-line corrector mechanism and the relative radiometric calibration procedure by Phua et al. (2008) was applied prior to building the mosaic layers for the years analyzed. The classification and mapping followed the protocols established by the module BL-UP and X-STR. For detailed procedures see Sections 3.1, 4.3.1 and 4.3.2. • Entity responsible for the measurement: IBAP • Accuracy: The minimum map accuracy must be 90% for the classification of forest/non-forest in the remote sensing imagery.
Frequency of monitoring/recording	Must be updated upon baseline revision, at least every ten years.
Value applied:	• Cacheu (2002-2010): 10,487 • Cantanhez (2002-2010): 21,213
Monitoring equipment	• Remote sensing data; • Computer, GIS software; • GPS; • Digital Camera; • Spreadsheets.
QA/QC procedures to be applied	If the classification accuracy is less than 90% then the maps is not acceptable for further analysis. More remote sensing data and ground truthing data will be needed to produce a product that reaches the 90% minimum mapping accuracy.
Purpose of data	• Determination of baseline scenario
Calculation method	For the current baseline, Landsat images date from 2002, 2007

	and 2010 in periods between January and April were collected. Fieldwork for ground truthing took place on the dry season of 2010 and 2012, totaling 261 validation coordinates (125 in Cacheu and 136 and Cantanhez). The calculation method is based on map algebra using gis software. All land cover transition is identified and the related transition areas calculated. A transition matrix is build to sum up all the conversion of forest areas (in ha) to non-forest areas (in ha). Detailed calculation methos are presented on Sections 3.1, 4.3.1 and 4.3.2.
Comments	Monitored for the purpose of baseline revision

Data / Parameter	A_i
Data unit	ha
Description	Area of stratum i
Source of data	Remote sensing imagery in combination with GPS data collected during ground truthing
Description of measurement methods and procedures to be applied	• Methods and procedures: mid-resolution satellite imagery, like Landsat, is the most commonly data source used for land cover classification and land cover change analysis in large areas. Pre-processed Landsat images are used in a mapping operation that follows a three-step approach: preprocessing, classification, and validation. The preprocessing included geometric corrections, radiometric calibration, and gap fill for the 2010 images. The gap fill methodology by Scaramuzza et al. (2004) was applied to the 2010 images affected by the malfunctioning of the Scan-line corrector mechanism and the relative radiometric calibration procedure by Phua et al. (2008) was applied prior to building the mosaic layers for the years analyzed. The classification and mapping followed the protocols established by the module BL-UP and X-STR. For detailed procedures see Sections 3.1, 4.3.1 and 4.3.2. • Entity responsible for the measurement: IBAP • Accuracy: The minimum map accuracy must be 90% for the classification of forest/non-forest in the remote sensing imagery.
Frequency of monitoring/recording	Must be updated upon baseline revision, at least every ten years.
Value applied:	The adjusted values correcting misclassification bias in satellite-based areal cover type estimates (Walsh and Burk, 1993) are: • Closed Forest: 6,915

	• Open Forest: 60,168 • Savanna: 18,633 • Mangrove: 55,740
Monitoring equipment	• Remote sensing data; • Computer, GIS software; • GPS; • Digital Camera; • Spreadsheets.
QA/QC procedures to be applied	If the classification accuracy is less than 90% then the maps is not acceptable for further analysis. More remote sensing data and ground trothing data will be needed to produce a product that reaches the 90% minimum mapping accuracy.
Purpose of data	• Calculation of project emissions
Calculation method	For the current baseline, Landsat images dated from 2002, 2007 and 2010 in periods between January and April were collected. Fieldwork for ground truthing took place on the dry season of 2010 and 2012, totaling 261 validation coordinates (125 in Cacheu and 136 and Cantanhez). The calculation method is based on well-known GIS technics. Satelite imagery is classified using classification software (commercial or open source) and the classification is validated using ground thruthing data (GPS coordinates and observed land cover type) to comply with methodology accuracy requirements. Detailed calculation methos are presented on Sections 3.1, 4.3.1 and 4.3.2.
Comments	Ex-ante it shall be assumed that strata area will remain constant for the baseline period.

Data / Parameter	Regional Forest Cover / Non-Forest Cover Benchmark Map
Data unit	Dimensionless
Description	Map showing the location of forest land within the RRD at the beginning of each project crediting period
Source of data	Remote sensing data in combination with GPS data collected during ground truthing
Description of measurement methods and procedures to be applied	• Methods and procedures: Landsat, or similar mid-resolution, images used in the mapping operation must follow a three-step approach: preprocessing, classification, and validation. The preprocessing includes geometric corrections and radiometric calibration. The classification and mapping must follow the protocols established by the module BL-UP and X-STR. The benchmark RRD Forest Cover map will be used as the baseline to the

	quantification of deforestation rates in the Reference Region. • Entity responsible for the measurement: IBAP • Accuracy: the minimum map accuracy must be 90% for the classification of the forest/non-forest in the remote sensing imagery.
Frequency of monitoring/recording	Update frequency at a minimum three times over the ten years leading up to baseline renewal (every 10 years).
Value applied:	Not applicable
Monitoring equipment	• Remote sensing data; • Computer, GIS software; • GPS; • Digital Camera; • Spreadsheets.
QA/QC procedures to be applied	If map classification accuracy is less than 90% then the map is not acceptable for further analysis. More remote sensing data and ground truthing data will be needed to produce a product that reaches the 90% minimum mapping accuracy.
Purpose of data	• Determination of baseline scenario • Calculation of baseline emissions
Calculation method	The classification and mapping must follow the protocols established by the module BL-UP and X-STR. For the current baseline, landsat images date from January 2010 until April 2010 were collected. Fieldwork for ground truthing took place on the dry season of 2010 and 2012, totaling 261 validation coordinates (125 in Cacheu and 136 and Cantanhez). The calculation method is based on well-known GIS technics. Satelite imagery is classified using classification software (commercial or open source) and the classification is validated using ground thruthing data (GPS coordinates and observed land cover type) to comply with methodology accuracy requirements.
Comments	Where forestland contains more than one forest class, the map must be stratified into forest classes using module X-STR

Data / Parameter	Project Forest Cover Benchmark Map
Data unit	Dimensionless
Description	Map showing the location of forestland within the Project Area at the beginning of each project crediting period.
Source of data	Remote sensing data in combination with GPS data collected during ground truthing

Description of measurement methods and procedures to be applied	• Methods and procedures: Landsat, or similar mid-resolution, images used in the mapping operation must follow a three-step approach: preprocessing, classification, and validation. The preprocessing includes geometric corrections and radiometric calibration. The classification and mapping must follow the protocols established by the module BL-UP and X-STR. The benchmark Project Area Forest Cover map will be used as the baseline for forest cover changes in the Project Area. • Entity responsible for the measurement: IBAP • Accuracy: the minimum map accuracy must be 90% for the classification of the forest/non-forest in the remote sensing imagery.
Frequency of monitoring/recording	Update frequency at a minimum three times over the ten years leading up to baseline renewal (every 10 years).
Value applied:	Not applicable
Monitoring equipment	• Remote sensing data; • Computer, GIS software; • GPS; • Digital Camera; • Spreadsheets.
QA/QC procedures to be applied	If map classification accuracy is less than 90% then the map is not acceptable for further analysis. More remote sensing data and ground truthing data will be needed to produce a product that reaches the 90% minimum mapping accuracy.
Purpose of data	• Determination of baseline scenario • Calculation of baseline emissions
Calculation method	The classification and mapping must follow the protocols established by the module BL-UP and X-STR. For the current baseline, landsat images date from January 2010 until April 2010 were collected. Fieldwork for ground truthing took place on the dry season of 2010 and 2012, totaling 261 validation coordinates (125 in Cacheu and 136 and Cantanhez). The calculation method is based on well-known GIS technics. Satelite imagery is classified using classification software (commercial or open source) and the classification is validated using ground thruthing data (GPS coordinates and observed land cover type) to comply with methodology accuracy requirements.
Comments	Where forestland contains more than one forest class, the map must be stratified into forest classes using module X-STR.

Data / Parameter	Leakage Belt Forest Cover Benchmark Map
Data unit	Dimensionless
Description	Map showing the location of forestland within the Leakage Belt at the beginning of each project crediting period.
Source of data	Remote sensing data in combination with GPS data collected during ground truthing
Description of measurement methods and procedures to be applied	• Methods and procedures: Landsat, or similar mid-resolution, images used in the mapping operation must follow a three-step approach: preprocessing, classification, and validation. The preprocessing includes geometric corrections and radiometric calibration. The classification and mapping must follow the protocols established by the module BL-UP and X-STR. The benchmark Leakage Belt Forest Cover map will be used as the baseline for forest cover changes in the Leakage Belt. • Entity responsible for the measurement: IBAP • Accuracy: the minimum map accuracy must be 90% for the classification of the forest/non-forest in the remote sensing imagery.
Frequency of monitoring/recording	Update frequency at a minimum three times over the ten years leading up to baseline renewal (every 10 years).
Value applied:	Not applicable
Monitoring equipment	• Remote sensing data; • Computer, GIS software; • GPS; • Digital Camera; • Spreadsheets.
QA/QC procedures to be applied	If map classification accuracy is less than 90% then the map is not acceptable for further analysis. More remote sensing data and ground truthing data will be needed to produce a product that reaches the 90% minimum mapping accuracy.
Purpose of data	• Determination of baseline scenario • Calculation of baseline emissions
Calculation method	The classification and mapping must follow the protocols established by the module BL-UP and X-STR. For the current baseline, landsat images date from January 2010 until April 2010 were collected. Fieldwork for ground truthing took place on the dry season of 2010 and 2012, totaling 261 validation coordinates (125 in Cacheu and 136 and Cantanhez). The calculation method is based on well-known GIS technics. Satelite imagery is classified

	using classification software (commercial or open source) and the classification is validated using ground thruthing data (GPS coordinates and observed land cover type) to comply with methodology accuracy requirements.
Comments	Where forestland contains more than one forest class, the map must be stratified into forest classes using module X-STR

Data / Parameter	Project Forest Cover Monitoring Map
Data unit	Dimensionless
Description	Map showing the location of forestland within the project area at the beginning of each monitoring period. If, within the Project Area, some forestland is cleared the map must show the deforested areas at each monitoring event.
Source of data	Remote sensing data in combination with GPS data collected during ground truthing
Description of measurement methods and procedures to be applied	• Methods and procedures: Landsat, or similar mid-resolution, images used in the mapping operation must follow a three-step approach: preprocessing, classification, and validation. The preprocessing includes geometric corrections and radiometric calibration. The classification and mapping must follow the protocols established by the module BL-UP and X-STR. The monitoring project area forest cover map will be compared to the benchmark project area forest cover map and land cover transitions areas from forest to non-forest in the project area quantified using map algebra • Entity responsible for the measurement: IBAP • Accuracy: the minimum map accuracy must be 90% for the classification of the forest/non-forest in the remote sensing imagery.
Frequency of monitoring/recording	Must be monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
Value applied:	Not applicable
Monitoring equipment	• Remote sensing data; • Computer, GIS software; • GPS; • Digital Camera; • Spreadsheets.
QA/QC procedures to be applied	If map classification accuracy is less than 90% then the map is not acceptable for further analysis. More remote sensing data and

	ground truthing data will be needed to produce a product that reaches the 90% minimum mapping accuracy.
Purpose of data	• Calculation of project emissions
Calculation method	Map algebra will be used to calculate forest to non-forest transitions.
Comments	Where forest land contains more than one forest class, the map must be stratified into forest classes using module X-STR

Data / Parameter	Leakage Belt Forest Cover Monitoring Map
Data unit	Dimensionless
Description	Map showing the location of forestland within the Leakage Belt area at the beginning of each monitoring period.
Source of data	Remote sensing using in combination with GPS data collected during ground truthing
Description of measurement methods and procedures to be applied	• Methods and procedures: Landsat, or similar mid-resolution, images used in the mapping operation must follow a three-step approach: preprocessing, classification, and validation. The preprocessing includes geometric corrections and radiometric calibration. The classification and mapping must follow the protocols established by the module BL-UP and X-STR. The monitoring leakage belt cover map will be compared to the benchmark leakage belt cover map and land cover transitions areas from forest to non-forest in the leakage belt quantified using map algebra • Entity responsible for the measurement: IBAP • Accuracy: the minimum map accuracy must be 90% for the classification of the forest/non-forest in the remote sensing imagery.
Frequency of monitoring/recording	Must be monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
Value applied:	Not applicable
Monitoring equipment	• Remote sensing data; • Computer, GIS software; • GPS; • Digital Camera; • Spreadsheets.
QA/QC procedures to be applied	If map classification accuracy is less than 90% then the map is not acceptable for further analysis. More remote sensing data and

	ground truthing data will be needed to produce a product that reaches the 90% minimum mapping accuracy.
Purpose of data	• Calculation of leakage
Calculation method	Map algebra will be used to calculate forest to non-forest transitions.
Comments	Where forest land contains more than one forest class, the map must be stratified into forest classes using module X-STR

Data / Parameter	Degradation PRA Results
Data unit	Dimensionless
Description	Degradation potential identified through the Participatory Rural Appraisal (PRA) determining if there is the potential for illegal extraction of trees to occur
Source of data	Interviews with the communities inside and surrounding the project area
Description of measurement methods and procedures to be applied	• Methods and procedures: the PRA consists of semi-structured interviews / questionnaires. The PRA shall evaluate whether the following activities may be occurring in the project area: (i) harvesting of fuel wood, (ii) harvesting of wood for charcoal production and (iii) timber harvest. If ≥ 10% of those interviewed/surveyed suggest that degradation may be occurring within the project boundary then the limited on the ground degradation survey shall be triggered. An additional output of the PRA shall be a depth of penetration of degradation pressure. A maximum distance shall be recorded for penetration into the forest from access points (such as roads, rivers, already cleared areas) for the purpose of harvesting fuel wood, charcoal and/or timber. It is likely that differing distances shall exist for each degradation pressure. If multiple pressures exist in the same stratum the deepest depth of penetration shall be used to define $A_{deg,i}$ • Entity responsible for the measurement: IBAP • Accuracy: communities need to be sampled inside and on the surroundings of the project area and within 2 km of the boundaries of the Leakage Belt to avoid bias. Sampling must be randomly designed and at least 10% of communities shall be sampled. If 10% of communities are less than 10 communities then the sample size shall be set as 10 or 100% of the communities. If 10% is more than 10 communities then the sample size shall be set as 30.

Frequency of monitoring/recording	The PRA must be updated every two years
Value applied:	0 (no potential for degradation)
Monitoring equipment	• GPS; • Field interview forms; • Spreadsheets.
QA/QC procedures to be applied	Communities locations shall be structured in a geo referenced database. If communities no longer exist or new settlements are established the database must be updated. All information collected on the field (i.e. questionnaires, spreadsheets) must be digitalized. Information must be recorded and backed-up digitally and physical copies stored at IBAP headquarters. Prior to PRA update the field team must be trained both on the interview method and on the questionnaire template.
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Calculation method	Semi-structured intervews with the communities to identify forest degradation potential
Comments	The PRA developed indicated no significant risk of degradation, therefore for ex-ante quantification emissions from degradation is considered zero.

Data / Parameter	Result of Limited Degradation Survey
Data unit	Dimensionless
Description	Rapid assessment to evaluate potential for degradation allowing the delineation of the areas that are potentially subjected to degradation.
Source of data	Field sampling
Description of measurement methods and procedures to be applied	• Methods and procedures: The area subjected to degradation shall be delineated based on an access buffer from all access points, such as roads and rivers or previously cleared areas, to the project area, with a width equal to the distance of degradation penetration. The area shall be sampled by surveying several transects of known length and width across the access-buffer area (equal in area to at least 1% of $A_{Deg,i}$) to check whether new tree stumps are evident or not. If there is little to no evidence that trees are being harvested then degradation can be assumed to be zero and no monitoring is needed. If degradation indications exist, systematic sampling must

	be conducted. • Entity responsible for the measurement: IBAP • Accuracy: T-SIG shall be used to establish significance.
Frequency of monitoring/recording	Must be repeated each time the PRA indicates a potential for degradation
Value applied:	Not applicable
Monitoring equipment	• Remote sensing data; • GPS; • Digital Camera; • Diametric tape; • Field sampling spreadsheets; • Computer, GIS software.
QA/QC procedures to be applied	All information collected on the field (i.e. questionnaires, spreadsheets, tree stump data) must be digitalized. Information must be recorded and backed-up digitally and physical copies stored at IBAP headquarters. Prior to PRA update the field team must be trained following a specific SOP detailing field and data collection methods. All maps produced delineating degradation areas must comply with the same error limit as established for other mapping activities in the monitoring plan (limit of 90%).
Purpose of data	• Calculation of project emissions
Calculation method	The sampling plan must be designed using plots systematically placed over the buffer zone so that they sample at least 3% of the area of the buffer zone. The diameter of all tree stumps will be measured and conservatively assumed to be the same as the DBH.
Comments	The PRA developed indicated no significant risk of degradation, therefore for ex-ante quantification emissions from degradation is considered zero.

Data / Parameter	$A_{DefPA, i, u, t}$
Data unit	ha
Description	Area of recorded deforestation in the project area in stratum i converted to land use u at time t
Source of data	Remote sensing imagery
Description of measurement methods and procedures to be	• Methods and procedures: Landsat, or similar mid-resolution, images used in the mapping operation must follow a three-step approach: preprocessing, classification, and

applied	validation. The preprocessing includes geometric corrections and radiometric calibration. The classification and mapping must follow the protocols established by the module BL-UP and X-STR. The monitoring forest cover map will be compared to the benchmark forest cover map and land cover transitions areas from forest to non-forest in the project area quantified using map algebra • Entity responsible for the measurement: IBAP • Accuracy: the minimum map accuracy must be 90% for the classification of the forest/non-forest in the remote sensing imagery.
Frequency of monitoring/recording	Must be monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
Value applied:	Not applicable
Monitoring equipment	• Remote sensing data; • Computer, GIS software; • GPS; • Digital Camera; • Spreadsheets.
QA/QC procedures to be applied	All data sources and analytical procedures will be documented and archived. Accuracy of the classification must be assessed by comparing the classification with ground truthing samples.
Purpose of data	• Calculation of project emissions
Calculation method	Map algebra will be used to calculate forest to non-forest transitions.
Comments	Ex-ante quantification considers deforestation in the Project Area equal to zero since IBAP keep permanence presence on both Cacheu and Cantanhez with clear infrastructure, patroling and policies are in place to prevent deforestation.

Data / Parameter	$A_{DefLB, i, u, t}$
Data unit	ha
Description	Area of recorded deforestation in the leakage belt in stratum i converted to land use u at time t
Source of data	Remote sensing imagery
Description of measurement methods and procedures to be applied	• Methods and procedures: Landsat, or similar mid-resolution, images used in the mapping operation must follow a three-step approach: preprocessing, classification, and validation. The preprocessing includes geometric

	corrections and radiometric calibration. The classification and mapping must follow the protocols established by the module BL-UP and X-STR. The monitoring forest cover map will be compared to the benchmark forest cover map and land cover transitions areas from forest to non-forest in the leakage belt quantified using map algebra • Entity responsible for the measurement: IBAP • Accuracy: the minimum map accuracy must be 90% for the classification of the forest/non-forest in the remote sensing imagery.
Frequency of monitoring/recording	Must be monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
Value applied:	Not applicable
Monitoring equipment	• Remote sensing data; • Computer, GIS software; • GPS; • Digital Camera; • Spreadsheets.
QA/QC procedures to be applied	All data sources and analytical procedures will be documented and archived. Accuracy of the classification must be assessed by comparing the classification with ground truthing samples.
Purpose of data	• Calculation of leakage
Calculation method	Map algebra will be used to calculate forest to non-forest transitions.
Comments	Ex-ante quantification of deforestation in the leakage belt is performed applying the module LK-ASU

Data / Parameter	$A_{DegW,\ i}$
Data unit	ha
Description	Area potentially impacted by degradation processes in stratum i
Source of data	GIS delineation and ground truthing
Description of measurement methods and procedures to be applied	• Methods and procedures: the parameter is composed of a buffer from all access points, such as roads and rivers or previously cleared areas. The width of the buffer shall be determined by the depth of degradation penetration as defined as a PRA output. The sampling plan must be designed using plots systematically placed over the buffer zone so that they sample at least 3% of the area of the buffer zone. The diameter of all tree stumps will be

	measured and conservatively assumed to be the same as the DBH. • Entity responsible for the measurement: IBAP • Accuracy: degradation area delineation must be validated using ground truthing data according to the sampling plan
Frequency of monitoring/recording	Must be repeated each time the PRA indicates a potential for degradation.
Value applied:	Not applicable
Monitoring equipment	• Remote sensing data; • Computer, GIS software; • GPS; • Digital Camera; • Spreadsheets.
QA/QC procedures to be applied	All data collected and analytical procedures will be documented and archived. Areas under degradation must be validated using ground truthing. The field team will be trained according to an appropriate SOP to identify and measure tree stumps.
Purpose of data	• Calculation of project emissions
Calculation method	Map algebra will be used to calculate forest loss due to degradation.
Comments	Not applicable

Data / Parameter	$A_{DistPA, q, i, t}$
Data unit	ha
Description	Area impacted by natural disturbances in the project stratum i converted to natural disturbance stratum q at time t
Source of data	Remote Sensing imagery combined with ground verification or GPS coordinates
Description of measurement methods and procedures to be applied	• Methods and procedures: where natural disturbance occur ex-post in the project area such as tectonic activity, extreme weather, pest, drought or fire that result in a degradation of forest carbon stock, the area disturbed shall be delineated. Using map algebra, the area impacted by natural disturbance is equal to the area that overlap between the delineated area of disturbance and the area of unplanned deforestation in the project area. • Entity responsible for the measurement: IBAP • Accuracy: degradation area delineation must be validated using ground truthing data of GPS coordinates. Emissions resulting from natural disturbances may be omitted if they

	are deemed de minimis through the use of the module T-SIG
Frequency of monitoring/recording	Must be monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
Value applied:	Not applicable
Monitoring equipment	• Remote sensing data; • Computer, GIS software; • GPS; • Digital Camera; • Spreadsheets.
QA/QC procedures to be applied	All data sources and analytical procedures will be documented and archived. Accuracy of the classification must be assessed by comparing the classification with ground truthing or GPS samples.
Purpose of data	• Calculation of project emissions
Calculation method	Map algebra to overlap the areas undergoing natural disturbance and the project area.
Comments	Not applicable

Data / Parameter	AP_i
Data unit	ha
Description	Total area of degradation sample plots in stratum i
Source of data	Ground measurement
Description of measurement methods and procedures to be applied	• Methods and procedures: calculated by summing the area (slope corrected) of sample plots measures in the sample of $A_{Deg,W,\,i,\,t}$. • Entity responsible for the measurement: IBAP • Accuracy: total area must be slope corrected
Frequency of monitoring/recording	Must be monitored at least every 5 years or if verification occurs on a frequency of less than every five years examination occur prior to any verification event.
Value applied:	Not applicable
Monitoring equipment	• Remote sensing data; • Computer, GIS software; • GPS; • Digital Camera; • Spreadsheets.
QA/QC procedures to be	Incident areas of potential degradation are confirmed and

applied	delineated in the field using GPS, sample plot dimensions are measured in the field on plot establishment.
Purpose of data	• Calculation of project emissions
Calculation method	Calculated by summing the area (slope corrected) of sample plots measures in the sample of $A_{Deg,W, i, t}$.
Comments	For ex-ante quantification degradation is considered zero

Data / Parameter	$C_{DegW, i, t}$
Data unit	t CO_2e
Description	Biomass carbon of trees cut and removed through illegal logging and fuelwood and charcoal extraction degradation process from plots measured in stratum i at time t
Source of data	Field measurement
Description of measurement methods and procedures to be applied	• Methods and procedures: temporary circular sample plots will be allocated and measured in the area of potential logging. Diameter at cut height of stumps will be measured. Significance of GHG emissions shall be assessed using T-SIG. If emissions from degradation is deemed significant, biomass of trees cut and removed will be estimated from measured diameter (conservatively assuming that diameter at stump cut are equivalent to DBH) applying allometric equations from Chave et al. (2005) and Delayne (1999) • Entity responsible for the measurement: IBAP • Accuracy: the proposed approach to consider diameter at cut height equivalent to DBH assures the conservativeness of the parameter
Frequency of monitoring/recording	Must be monitored at least every 5 years or if verification occurs in a frequency of less than every 5 years examination must occur prior to any verification event
Value applied:	Not applicable
Monitoring equipment	• Diametric Tape; • GPS; • Digital Camera; • Spreadsheets.
QA/QC procedures to be applied	All data sources and analytical procedures will be documented and archived.
Purpose of data	• Calculation of project emissions
Calculation method	Estimated from diameter measurements of cut stumps in the

	sample plots
Comments	For ex-ante quantification degradation is considered zero

Data / Parameter	$C_{AB,tree,i}$
Data unit	tCO_2e ha^{-1}
Description	Carbon Stock in aboveground biomass in trees in Cantanhez and Cacheu in stratum i
Source of data	Field Measurement (Winrock/IICT 2012) applied with allometric equation published in Chave et al. (2005) and Delaney (1999)
Description of measurement methods and procedures to be applied	• Methods and procedures: see Section 4.3.4 • Entity responsible for the measurement: IBAP • Accuracy: see Section 4.3.4
Frequency of monitoring/recording	Must be monitored at least every 5 years or if verification occurs in a frequency of less than every 5 years examination must occur prior to any verification event
Value applied:	Cacheu • Open Forest: 132.88 • Savanna: 97.70 • Mangrove: 72.89 Cantanhez • Closed Forest: 306.11 • Open Forest: 127.01 • Savanna: 101.43 • Mangrove: 100.45
Monitoring equipment	• Diametric Tape; • Hypsometer; • Remote sensing data; • Computer, GIS software; • GPS; • Digital Camera; • Spreadsheets.
QA/QC procedures to be applied	Independent 3rd party audit of field data and procedures.
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Calculation method	See Section 4.3.4

Comments	Not applicable

Data / Parameter	$DBH_{tree, i}$
Data unit	cm
Description	Diameter at breast height of a tree
Source of data	Field measurement
Description of measurement methods and procedures to be applied	• Methods and procedures: typically measured at 1.3 aboveground. Detail on methods and procedures are presented on Section 4.3.4 • Entity responsible for the measurement: IBAP • Accuracy: procedures for accuracy assurance for forest inventory are detailed on section 4.3.4.
Frequency of monitoring/recording	Monitoring must occur at least every ten years from baseline renewal.
Value applied:	Not applicable
Monitoring equipment	• GPS; • Diametric tape; • Hypsometer.
QA/QC procedures to be applied	Independent 3rd party audit of field data and procedures. Field observation sheets will include DBH of each measured tree for evaluation of reasonableness of measurement based on feasible growth rate.
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Calculation method	See Section 4.3.4
Comments	Not applicable

Data / Parameter	H
Data unit	m
Description	Total height of tree
Source of data	Field measurement
Description of measurement methods and procedures to be applied	• Methods and procedures: height measure undertook using a hypsometer. Detail on methods and procedures are presented on Section 4.3.4 • Entity responsible for the measurement: IBAP • Accuracy: procedures for accuracy assurance for forest inventory are detailed on section 4.3.4.

Frequency of monitoring/recording	Monitoring must occur at least every ten years from baseline renewal.
Value applied:	Not applicable
Monitoring equipment	• GPS; • Hypsometer.
QA/QC procedures to be applied	Independent 3rd party audit of field data and procedures. Field observation sheets will include H of each measured tree for evaluation of reasonableness of measurement based on feasible growth rate.
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Calculation method	See Section 4.3.4
Comments	Not applicable

Data / Parameter	$C_{BB,tree,i}$
Data unit	$tCO_2e\ ha^{-1}$
Description	Carbon Stock in belowground biomass in trees in Cantanhez and Cacheu in stratum i
Source of data	Field Measurement (Winrock/IICT 2012) applied with root-to-shoot rations
Description of measurement methods and procedures to be applied	• Methods and procedures: see Section 4.3.4 • Entity responsible for the measurement: IBAP • Accuracy: see Section 4.3.4
Frequency of monitoring/recording	Must be monitored at least every 5 years or if verification occurs in a frequency of less than every 5 years examination must occur prior to any verification event
Value applied:	Cacheu • Open Forest: 35.23 • Savanna: 26.49 • Mangrove: 33.39 Cantanhez • Closed Forest: 84.15 • Open Forest: 33.77 • Savanna: 28.18 • Mangrove: 46.01
Monitoring equipment	Not applicable

QA/QC procedures to be applied	Independent 3rd party audit of field data and procedures.
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Calculation method	See Section 4.3.4
Comments	Not applicable

Data / Parameter	$C_{AB,tree,post,i}$
Data unit	$tCO_2e\ ha^{-1}$
Description	Post-deforestation carbon stock in aboveground biomass in trees in Cantanhez and Cacheu in stratum i
Source of data	Field Measurement or literature data
Description of measurement methods and procedures to be applied	• Methods and procedures: see Section 3.1.5 • Entity responsible for the measurement: IBAP • Accuracy: see Section 3.1.5
Frequency of monitoring/recording	At least every 10 years upon baseline revision
Value applied:	7.8
Monitoring equipment	If field measurement is undertaken the following equipments shall be applied: • Diametric Tape; • Hypsometer; • Remote sensing data; • Computer, GIS software; • GPS; • Digital Camera; • Spreadsheets. In case literature data is applied, monitoring equipments are not applicable.
QA/QC procedures to be applied	Independent 3rd party audit of field data and procedures.
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Calculation method	See Section 3.1.5
Comments	For the current baseline, default carbon stock values extracted

	from IPCC are applied to the land uses described in Temudo (1998) and Silva et al. (2011) to calculate the carbon stocks in the post deforestation scenario.

Data / Parameter	$A_{burn, i, t}$
Data unit	ha
Description	Area burnt at time t (if any occurs)
Source of data	Remote sensing imagery
Description of measurement methods and procedures to be applied	• Methods and procedures: using GIS and Landsat imagery delineate area burnt at time t • Entity responsible for the measurement: IBAP • Accuracy: map accuracy must comply with methodology requirements (90% minimum)
Frequency of monitoring/recording	Must be monitored at least every 5 years or if verification occurs in a frequency of less than every 5 years examination must occur prior to any verification event
Value applied:	Not applicable
Monitoring equipment	• Remote sensing data; • Computer, GIS software; • GPS; • Digital Camera; • Spreadsheets.
QA/QC procedures to be applied	Incident areas of fire are confirmed and delineated in the field using GPS.
Purpose of data	• Calculation of project emissions
Calculation method	Total burnt area is quantified using map algebra
Comments	For ex-ante quantification degradation is considered zero

Data / Parameter	A_{sp}
Data unit	ha
Description	Area of sample plots in ha
Source of data	Recording and archiving of number and size of sample plots
Description of measurement methods and procedures to be applied	• Methods and procedures: the project applies circular nested plots. The outter circle has 20 mts and the area is sloped adjusted in the field using a hypsometer. For details see Section 4.3.4 • Entity responsible for the measurement: IBAP • Accuracy: the hypsometer shall be calibrated according to

	factory procedures before field campaigns.
Frequency of monitoring/recording	Monitoring must occur at least every ten years for baseline renewal.
Value applied:	0,13 ha (radius of 20 mts)
Monitoring equipment	• Remote sensing data; • Computer, GIS software; • Hypsometer; • GPS; • Digital Camera; • Spreadsheets.
QA/QC procedures to be applied	Personel must be trained in the operation of hypsometers and how to correct for slope in the terrain. All data must be recorded and backuped in multiple locations including physical copies and digital copies (HDs, servers, cloud)
Purpose of data	• Calculation of baseline emissions
Calculation method	Plots are circular. Three circles are nested, the bigger with 20 mts, the intermediary with 14 mts and the internal with 4 mts. For detailes on calculation methods see Section 4.3.4
Comments	Not applicable

Data / Parameter	N
Data unit	Dimensionless
Description	Number of sample points
Source of data	Recording and archiving of number of sample points
Description of measurement methods and procedures to be applied	• Methods and procedures: Plots are randomly selected over a 250x250 grid of points. For details see Section 4.3.4 • Entity responsible for the measurement: IBAP • Accuracy: when overlaying the grid of points standard mapping procedures shall be observed to avoid distortion os misplacement of points.
Frequency of monitoring/recording	Monitoring must occur at least every ten years for baseline renewal.
Value applied:	259 plots
Monitoring equipment	• Remote sensing data; • Computer, GIS software; • GPS;
QA/QC procedures to be	Personel must be trained in GIS and digital mapping operations. All data must be recorded and backuped in multiple locations

applied	including physical copies and digital copies (HDs, servers, cloud)
Purpose of data	• Calculation of baseline emissions
Calculation method	A 250 x 250 meter systematic grid of points with a random origin shall be created. The number of plots to be sampled in each stratum are determined based on three considerations: (1) the variability of biomass within a stratum (evaluated using previously collected data); (2), the estimated area covered by each stratum; and (3) the target precision level (set at 15%, 95% CI). Sample plots are then randomly selected for each stratum that were deforested and need to be revised over the grid. Selected plot coordinates shall be loaded into GPS equipment and later used in the field to reach the center of each plot. For detailes on calculation methods see Section 4.3.4
Comments	Not applicable

4.3 Monitoring Plan

The project monitoring and reporting process is IBAP's Monitoring Unit responsibility. IBAP is responsible for the conservation and management of forest-related biodiversity in Guinea-Bissau, and in the past ten years has recruited qualified staff and has grown into a fully functioning institution, coordinating the day-to-day management of more than 450,000 ha of critical natural habitats. Figure 14 presents an overview of the monitoring process and defines the structure of IBAP's Monitoring Unit to be implemented for the monitoring of this project.

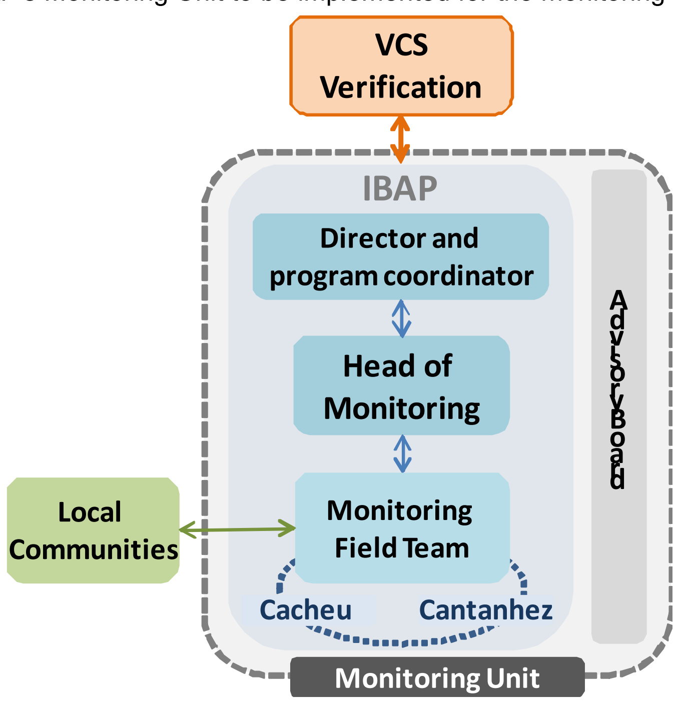


Figure 14. Overview of the monitoring process and structure.

The monitor reports will be developed by the head of monitoring and discussed amongst all parts of the monitoring unit. Specific groups of the monitoring team will be responsible for forest monitoring map production, others for ground observations, data compilation, and carbon stock assessments, and others for working mostly with the communities and apply PRA techniques to assess forest degradation risks. The monitoring team reports in each of these components directly to the head of monitoring, receiving feedback from the head of monitoring in order to improve the quality of the data and ensure that the standard operating procedures (SOPs) and QC/QA procedures are followed. The head of monitoring will be responsible for the final compilation of all data, ensure data achieving, and for reporting. He is also responsible for setting up corrective or preventing actions to avoid non-conformances with the validated monitoring plan. The forest monitoring is developed in a process of continuous improvement, which means that all the activities to be monitored by the monitoring team are subject to a report to be revised by the head of monitoring. This process of internal audit shall be used namely to identify deviations or non-conformances, that if occurring shall be recorded/computized and a report shall be developed justifying the conservativeness of the monitoring approach. If deemed necessary, correction action plans (CAPs) are developed and SOPs adjusted in the Monitoring Plan, including if a non-conformance is identified and the justification report fails to prove the conservativeness of the new method, equipment or strategy. SOPs are developed and updated with the assistance of external carbon experts or advisory board and are provided by the head of monitoring to the monitoring field team. The monitoring unit will have the support and guidance of an advisory board in all stages. This advisory board includes carbon and remote sensing experts that will assist with data entry, compilation of inventory results, and remote sensing work. The importance of these experts will gradually diminish and become occasional as IBAP gains technical independence in all monitoring activities. Table 15 synthesizes the responsibilities of each group of the monitoring unit.

Table 26. Overview of the responsabilities of the monitoring team.

Group/Staff	Responsibility
Director / Program Coordinator	Managing the VCS verification process
	Revise monitoring reports from the head of monitoring and provide feedback
	Reporting
	Ensure engagement and support of external consultants and other members of the advisory board
Head of Monitoring	Compile data
	Data archiving
	Ensure consistency between the monitoring field team collecting data in the two parks
	Prepare monitoring reports
	Drafting SOPs
	Prepare CAPs when needed

	Selection of qualified staff for each specific activity to be performed by the monitoring field team (in collaboration with the Parks' Director)
	Identify training requirements
	Main liaison with the advisory board
	Liaison between the monitoring field team and the director and program coordinator
	Ensure that the quality control procedures are being implemented
	Plan and coordinate the Monitoring Field Team activities
Monitoring Field Team	Field data collection
	Data entry
	Data archiving
	Equipment maintenance and calibration
	Forest monitoring map production
	Prepare reports to the head of monitoring
Advisory Board	Provide technical and scientific support when needed and as required by the head of monitoring and IBAP's Director / Program coordinator
	Technical review or pre-verification of the data
	Technical review of monitoring reports and consistency with the monitoring plan

All data collected as part of the monitoring program will be archived in both electronic and paper forms (when possible). To safeguard its security, copies of the data should be stored at IBAP's headquarters under the responsibility of the head of monitoring and at the offices of each Park (Cacheu and Cantanhez) under the supervision of the parks' directors. The archiving of the data will be under the responsibility of the head of monitoring with the supervision of IBAP's director / program coordinator. The QA/QC protocol will also be supervised by the head of monitoring and includes:

- Collect data to validate the information produced with remote sensing
- Ensure that the field team is trained - with biannual workshops, and discussion of SOPs
- Register all field members and their specific responsibilities, and archive that information together with the data collected (metadata)
- Routine checks of the data sheets to ensure data integrity and correct labelling.
- Cross-check of the input data for transcription errors conducted by personnel not directly involved in inventory and data compilation steps.
- Total transparency of the worksheet to enable reproduction of the emission and uncertainty estimates
- Revisit a sample of the measured plots to ensure the quality of the plot location (i.e. of the coordinates)
- Compare data from the GPS equipment with the coordinates in the field datasheet and in the excel workbook to identify and correct eventual transcription errors.
- Technical review or pre-verification of the data, and monitoring report will be conducted by the advisory board and IBAP's Director / Program coordinator

The ex-post monitoring has two key aspects: (i) monitoring according to the Monitoring Plan and (ii) revising the baseline every 10 years. Carbon stocks shall be revisited every 10 years together with the baseline deforestation update in the reference region because agents, drivers and underlying causes of deforestation change dynamically.

The Community Based Avoided Deforestation Project in Guinea Bissau must monitor land cover changes and degradation activities before verifications in order to assess ex-post emission reduction. The main goal of this Monitoring Plan is to present a protocol to the collection of the data that will allow the verification of the deforestation and degradation within the Project Area and its Leakage Belt throughout time, regularly updating the emissions estimation as well as the generation of sufficient and timely information to evaluate the impact of the on the ground community measures to reduce pressure over the forest and make the necessary adjustments.

This Monitoring Plan covers the parameters described in section 4.2 and monitors the area of forest land converted to non-forest land and associates changes in carbon stocks, the area of forest land undergoing loss in carbon from degradation activities and associated changes in carbon stocks, the area of forest land undergoing loss in carbon stocks resulting from natural disturbances and associated changes in carbon stocks and the greenhouse gas emissions associated with project implementation.

4.3.1 Revision of the Baseline

The baseline, as outlined in this PD, is valid for 10 years, through 31st of March 2011 until 30th of March 2021. The baseline will be updated every 10 years from the project start date because agents, drivers and underlying causes of deforestation change dynamically. The methodological procedure used to update the baseline shall be the same used in the definition of the baseline according to the PD and are further described in the following sections.

a. Technical Description of the monitoring task

The methodological procedure used to update the baseline shall be the same used in the first estimation (WB_revisionupdate_FINAL_Report_v6.pdf). The following parameters shall be estimated: net greenhouse gas emissions in the baseline from unplanned deforestation ($\Delta C_{BSL,unplanned}$), net greenhouse gas emissions due to activity shifting for projects preventing unplanned deforestation ($\Delta C_{LK-AS,unplanned}$), and the net greenhouse gas emissions within the project area under the project scenario (ΔC_P). Carbon stocks shall be re-estimated from new field measurement after 10 years of the current baseline. Standard methods of remote sensing used for the establishment of the baseline will be used for the updated of the following parameters when the baseline is revised: LB (Leakage Belt Area, in ha), PA (Unplanned Deforestation Project Area, in ha), P_{LK} (LK/RRD, dimensionless), P_{PA} (PA/RRD, dimensionless), RRD (Reference Area for the Projection of Deforestation, in ha) and T_{hrp} (Duration of the historical reference period, in years).

The procedures and data to be collected for the update of LB, PA and RRD are detailed on section (b) below. P_{LK} and P_{PA} are ratios that will be updated at least once every 10 years (when the baseline is revisited) using the parameters LB, PA and RRD. The parameter T_{hrp} depends on data availability at the moment of the baseline update. This parameter will be updated at least once every 10 years (when the baseline is revised) and must cover a historical reference period between 10 and 15 years.

b. Data to be collected

The update of the spatial boundaries LB, PA and RRD must follow the criteria established by the BL-UP Module. PA is the area inside Cantanhez and Cacheu National Parks covered by forestland in the end of the baseline historical period. The boundaries of the National Parks are fixed and established by law. The shapefiles are provided by IBAP. Mid resolution imagery (e.g. Landsat) or, if available, imagery with higher resolution sources (e.g. Sentinel) will be collected for three time periods from a historical reference period between 10 and 15 years (T_{hrp}). Image classification will be used to produce maps and calculate total area of forest cover in the National Parks to define the PA in hectare.

The Leakage Belt (LB) is the area suitable for activity shifting from the PA. LB must be updated following the criteria established by BL-UP that includes minimum area in relation to the PA, landscape factors (% forest type, % soil type, % slope proportion) and transport factors (river density, road density and population density). The same procedure used to establish the current baseline must be followed. Mid resolution imagery (e.g. Landsat) or, if available, imagery with higher resolution sources (e.g. Sentinel) will be collected for three time periods from a historical reference period between 10 and 15 years (T_{hrp}). Image classification will be used to produce maps of forest cover and, together with the previously listed criteria, update LB. If the minimal required area is not reached justification must be provided in accordance with BL-UP requirements.

The RRD is the reference area for projecting deforestation rate and must not encompass the PA and the LB. The update of RRD must follow the criteria established in the BL-UP module that includes deforestation agents, landscape factors and transportation network and infrastructure. Mid resolution imagery (e.g. Landsat) or, if available, imagery with higher resolution sources (e.g. Sentinel) will be collected for three time periods from a historical reference period between 10 and 15 years (T_{hrp}). Image classification will be used to produce maps of forest cover and, together with the previously listed criteria, update RRD. If the minimal required area is not reached to equal MREF, then MREF shall be made equal to the area that meets the listed criteria in accordance with BL-UP requirements.

For the reassessment of the carbon stocks of each stratum, new plots shall be established and measured. The field measurements used for the carbon stock assessment must be re-established at least once every 10 years (when the baseline is revisited).

c. Overview of data collection procedures

Similarly to the approach followed in the baseline presented in this PD, land cover change will be assessed based on maps obtained by processing satellite data. The type of satellite imagery, the scenes dates, and the processing methodology, must align with the requirements of VM0007 VCS REDD methodology and follow all the good practice guidelines for remote sensing analysis.

The remotely sensed data collected must be prepared for analysis. Minimum pre-processing involves geometric correction and geo-referencing and cloud and shadow detection and removal. All information on image pre-processing, classification procedures and map validation is presented below.

Pre-processing:

- Geometric Corrections - To remove distortions or degradations from the images, geometric corrections shall be made. This operation shall be performed using an ortho-rectified image. The process will involve Ground Control Points (GPC) distributed across the study area for all the images and years, and shall yield an acceptable overall accuracy expressed as an average root mean square error (RMSE). It is important to ensure that the RMSE is not greater than one pixel, in order to co-register images from different dates. Using the nearest neighbor resampling technique (which preserves the maximum raw spectral information) the images shall be resampled into the Universal Transverse Mercator projection (UTM, Zone 28 North, WGS84) with a 25m grid.

- Radiometric calibration - Each acquired image has its own atmospheric and phase angle effects. Therefore, a multi-date image normalization correction using regression must be applied to each pair of images (Jensen, 2005). All the images shall be radiometrically calibrated using a band-to-band linear regression (Phua et al., 2008; Lillesand & Kiefer, 1987). This approach normalizes the differences between the images from different dates, allowing data comparison, and facilitates the production of a homogeneous mosaic of scenes for all the years. This correction consists on selecting a base image and transforming the spectral characteristics of all other images obtained on different dates to have approximately the same radiometric scale as the base image (Jensen, 2005). To do that, pseudo-invariant features are selected in pixels that should change very little through time, e.g., deep-water bodies and bare soil. The relation of this pseudo-invariant features from the base image to the other images is done using regression equations, which will assume that the pixels sampled at time t+1 and t-1 are linearly related to the pixels for the same location on the base image (Jensen, 2005). Once these regressions equations are applied, the variations between images are removed and they can be used in the classification step.

- Fill gaps methodology in case of images with existing clouds or gaps - This operation is based on the SLC Gap-Filled Products Methodology and shall only be applied if needed. The process starts with the choice of the SLC- off scenes with gaps to fill (named primary scenes) and the scenes to fill the gaps (fill scenes).

Image classification:
The classification of each image shall be carried out with a maximum likelihood classifier (Lillesand & Kiefer, 1987). This approach uses the signatures that characterize each of the land cover classes extracted from training sites to calculate statistics, which are used to

evaluate the probability of each unknown pixel belonging to a given class. The class with the highest likelihood is attributed to the pixel.

To train the classifier training data shall be extracted using a color composite (RGB). The bands middle infrared (MIR), near infrared (NIR) and red are considered to be the most relevant for visual discrimination of land cover information. The data for the training sets shall be extracted by visual on-screen interpretation assisted by ancillary data and expert knowledge from previous field campaigns.

Assuming that the training area samples capture the variability and characteristics of the population, in order to improve consistency between the different dates, areas used for extracting training data shall be the same on different dates, except in those areas where land cover/use has changed between dates. A statistical analysis shall be made for each training class dataset and checked for class separability through the use of the Jeffries-Matusita (JM) distance (Matusita, 1966). The JM distance is a saturating transformation of the Bhattacharya distance (Jensen, 1996) with values between 0 (not separable) and 2 (classes perfectly separable). All the statistics shall be calculated only for land pixels, excluding water, due to tide differences among the different years. Some problems could occur due to localized geometric differences between the years. The algorithm used for classifying the imagery was developed under CARBOVEG-GB and the results of its application were verified by field observations across the country in all strata that are considered by the Project Activity.

After the first classification, the land cover maps shall be reclassified into a Forest vs Non-Forest map (two-class) with a minimum mapping unit of one hectare.

Validation

An accuracy assessment procedure shall be applied to access the accuracy and validate the land cover maps produced. The overall classification accuracy of the maps produced must be 90% or more.

Mapping land cover change

To assess the changes of forest areas, derive the deforested areas, and the new deforestation rates, Deforestation Maps showing areas of deforestation with paired data shall be produced for the RRD for the time periods between each new historic image. The areas of all possible transitions must be spatially identified and the transition matrices obtained through map algebra operations are used to estimate the new historical deforestation rates.

For the reassessment of the carbon stocks of each stratum, new plots shall be established and measured. The existing 250 x 250 meter systematic grid covering the entire country shall be stratified according to the most recent land cover map produced and used to determine the plots location. The number of plots to be measured shall meet the desired statistical precision of the methodology - i.e., 95% confidence interval is within 15% of the mean. A detailed description of the data collection is presented in section 4.3.4.

d. Quality control and quality assurance procedure

The accuracy assessment shall be performed over the latest Forest/Non-Forest and latest Terrestrial Forest/Non-Forest/Mangrove map using an independent dataset. For the accuracy assessment, a sampling strategy based on a 250x250 meter systematic grid of points with a random origin, created over the entire Guinea-Bissau territory and used as a basis for plot location in the carbon stock assessment activity shall be used. In addition, Non-Forest data shall be collected over very high-resolution data like Google Earth and used to confirm the validation. The confusion matrices provide the basis on which to both describe classification accuracy and characterize errors (Foody, 2002).

All data sources and analytical procedures described above to produce the data for the baseline renewal will be archived and documented, and all the procedures and data produced shall be checked or audited by the advisory board and IBAP's Director / Program coordinator.

e. Data archiving

Data will be archived and maintained electronically by IBAP at its headquarter in Bissau. All data sources and processing, classification and change detection will be documented and stored. Data to be archive must include raw imagery, ancillary cartographic data used, data used for training the classification, software version applied, classified images, data used for ground thruthing and final accuracy assessment matrix.

To safeguard its security, copies of the data should be stored at IBAP's headquarters under the responsibility of the head of monitoring and at the offices of each Park (Cacheu and Cantanhez) under the supervision of the parks' directors. The archiving of the data will be under the responsibility of the head of monitoring with the supervision of IBAP's director / program coordinator.

f. Organization and Responsibilities

The responsibility for each task of the baseline renewal shall be assigned based on the flowchart and table presented above.

The baseline renewal report will be developed by the head of monitoring with the supervision and revision of IBAP's director or the program coordinator.

4.3.2 Monitoring of Actual Carbon Stock Changes and GHG Emissions

Monitoring of actual emissions in the project area focuses on emissions due to deforestation and natural disturbance, illegal degradation and biomass burning.

Emissions due to deforestation and natural disturbances

a. Technical Description of the monitoring task

Forest cover change due to deforestation and natural disturbances is monitored through periodic assessment of classified satellite imagery covering the project area and ancillary data from direct or indirect monitoring that shall be used to identify and distinguish deforestation from natural disturbances. Natural disturbances may include wildfires, insect and disease infestations, and/or extreme weather events, beyond the control of, and not materially influenced by human activity, Although the immediate cause of wildfires may be difficult to determine, in Guinea-Bissau the use of fire is closely linked to cultural factors, Catastrophic events are also not expected in the Project Area or Leakage Belt. Nevertheless, if by any chance a catastrophic event or a wildfire (break out during a dry season, or due to lightning) presents during the Project's lifetime, such events will be reported if significant using a hybrid approach.

The objective of this monitoring task is to establish $A_{Def, PA,i,t}$ and $A_{Dist, PA,i,t}$ (Area Deforested and Impacted by Natural Disturbance in the Project Area in time t) and multiply these factors by the average forest carbon stock per unit area. The project boundary, as set in the PD, will serve as the initial forest cover benchmark map against which changes in forest cover will be assessed over the interval of the first monitoring period; the entire project area has been demonstrated to meet the forest definition at the beginning of the crediting period. Stocks estimates from the initial field inventory are valid for the initial baseline period (10 years) and will not have to be monitored during the baseline period. Upon baseline update forest carbon stock estimates will also be updated for any strata where deforestation or natural disturbance is detected.

b. Data to be collected

Mid resolution imagery (e.g. Landsat) or, if available, imagery with higher resolution sources (e.g. Sentinel) will be collected to produce maps that support the analysis of deforestation and natural disturbance during the monitoring period within the project area. Deforestation and natural disturbance will be distinguished using an hybrid approach of remote sensing with ground data, and a local community alert system with ground observations/measurements to identify and delineate disturbances due to natural events. In case an event is reported by the communities, monitoring procedures are triggered and direct ground measurements (using a GPS) are undertaken. Ground measurements will also be collected randomly over the areas mapped as deforested to identify possible disturbances due to natural events misclassified as anthropogenic deforestation.

c. Overview of data collection procedures

All procedures for image pre-processing (e.g. geometric corrections, radiometric calibration), image classification and map validation shall follow the procedures described for the baseline renewal (section 4.3.1 c). The deforestation maps produced will need to be analyzed to identify and exclude disturbed areas due to natural events.

Ancillary data which may include but is not limited to routine ground-based surveys to local communities, direct communications from local communities to the Park guards and authorities, information from local land manager, and direct ground observations/measurements to assess if, when, and to what extent extreme weather events or insect pests have occurred causing a disturbance in the forest constitute the local community alert system. When a natural event is reported through the system the direct monitoring procedures are triggered. A team of park guards will conduct ground surveys to gather evidence, including the georeferenced location of the occurrence, year and types of disturbances, and gather ground data to determine the extent to what the forests were affected by the reported disturbance. Although a statistical sampling scheme do not provide delineation of disturbed areas directly, this complementary ancillary method shall be used to assess if a deforested area identified using remote sensing techniques to map deforestation (MMU of 1 ha) was instead a change triggered by the occurrence of natural disturbance. To depict natural disturbances, techniques based on repetitive measurements of spectral, spatial and temporal indicators and/or increased spatial or spectral resolution of satellite observations shall be explored (e.g., Verbesselt et al., 2012[30]). A 250x250 meters grid of points shall be used for the validation of the deforestation maps (depicting two different types of disturbance: natural and anthropogenic), and 10% of the points over the deforested area shall be visited. In each selected point location the required information to determine if that area was subject to a natural event is registered.

d. Quality control and quality assurance procedure

The map accuracy assessment shall be performed over the latest Forest/Non-Forest and latest Terrestrial Forest/Non-Forest/Mangrove maps using an independent dataset and shall be performed for each future monitoring. For the accuracy assessment, a sampling strategy based on a 250x250 meter systematic grid of points with a random origin, created over the entire Guinea-Bissau territory shall be applied. This grid shall be stratified using land cove maps produces at each monitoring phase into four forest classes (Closed forest, Open forest, Savanna Woodland and Mangrove) which will be grouped to validate the Forest/non-Forest and Forest/Non-Forest/Mangrove map. In addition, Non-Forest data shall be collected over very high-resolution data like Google Earth and used to confirm the validation. The confusion matrices provide the basis on which to both describe classification accuracy and characterize errors (Foody, 2002).

All data sources and analytical procedures applied to produce the monitoring data will be archived and documented, and all the procedures and data produced shall be checked or audited by the advisory board and IBAP's Director / Program coordinator..

e. Data archiving

Data will be archived and maintained electronically by IBAP at its headquarter in Bissau. All data sources and processing, classification and change detection will be documented and stored. Data to be archive must include raw imagery, ancillary cartographic data used, data used for training the classification, software version applied, classified images, data used for

[30] Verbesselt J, Zeileis A, Herold M (2012). Near real-time disturbance detection using satellite image time series. Remote Sensing Of Environment, 123, 98–108. http://dx.doi.org/10.1016/j.rse.2012.02.022

ground thruthing and final accuracy assessment matrix. If existing, the natural disturbances reports, including the collected ground information registered in a field sheet, shall also be archived in IBAP's headquarters in Bissau under the responsibility of the head of monitoring, and a copy shall be kept by each parks' station (Cacheu and Cantanhez) under the supervision of the parks' directors.

f. Organization and Responsibilities

The responsibility for each monitoring task shall be assigned based on the flowchart and table presented above. The monitoring report will be developed by the head of monitoring in close coordination between the Parks Directors and with the supervision and revision of IBAP's director or the Program Coordinator. The advisory board is responsible for data inspection, for providing assistance as required by the head of monitoring and for the technical revision of the monitoring report.
Under the supervision of the Parks' Directors, the guards comprising the monitoring field team shall be responsible for conducting and managing the local community alert system to assess the occurrence of natural disturbances, and to communicate and interact with local communities, including applying PRA techniques when necessary. They will interact with the Park Director to identify risks and difficulties which will in turn communicate the issues to the head of monitoring and trigger the development of a corrective action plan (CAP), if required. These CAPs inform of any necessary revision of the field standard operating procedures (SOPs), or additional training requirements, thereby enabling the continuous improvement of the procedures.

Emissions due to Illegal Degradation

Degradation may take place in the project area due to illegal extraction of trees for timber or for fuel and charcoal. As remote methods for monitoring degradation are not available ground-based methods must be used. For the baseline, a Participatory Rural Appraisal (PRA) was conducted demonstrating that emissions from degradation are not occurring in the project area and in the buffer zone (2 km).

a. Technical Description of the monitoring task

Emissions due to illegal degradation will be tracked by conducting a PRA every 2 years. The first step in addressing forest degradation is to complete a participatory rural appraisal (PRA) of the communities inside and surrounding the project area (2 km) to determine if there is the potential for illegal extraction of trees to occur. If this assessment finds no potential pressure for these activities then degradation ($\Delta C_{P,DegW,i,t}$) can be assumed to be zero and no monitoring is needed.

b. Data to be collected

If the results of the PRA suggest that there is a potential for degradation activities, then limited field sampling must be undertaken. First, the area that is potentially subject to degradation needs to be delineated ($A_{Deg,i}$). An output of the PRA shall be a distance of degradation penetration from all access points (access buffer), such as roads and rivers or previously cleared areas, to the project area. The distance of degradation penetration will vary by form of degradation with a deeper penetration likely for illegal logging than for fuelwood and charcoal.

The area subject to degradation shall be delineated ($A_{DegW,i}$) based on an access buffer from all access points, such as roads and rivers or previously cleared areas, to the project area, with a width equal to the distance of degradation penetration. The area shall be sampled by surveying several transects of known length and width across the access-buffer area (equal in area to at least 1% of $A_{DegW,i}$) to check whether new tree stumps are evident or not. If there is little to no evidence that trees are being harvested then degradation can be assumed to be zero and no monitoring is needed. This limited sampling must to be repeated each time the PRA indicates a potential for degradation.

If the limited sampling does provide evidence that trees are being removed in the buffer area, then a more systematic sampling must be implemented. The sampling plan must be designed using plots systematically placed over the buffer zone so that they sample at least 3% of the area of the buffer zone ($A_{DegW,i}$). The diameter of all tree stumps will be measured and conservatively assumed to be the same as the DBH. If the stump is a large buttress, identify several individuals of the same species nearby and determine a ratio of the diameter at DBH to the diameter of buttress at the same height above ground as the measured stumps. This ratio will be applied to the measured stumps to estimate the likely DBH of the cut tree. The above and belowground carbon stock of each harvested tree must be estimated using the same allometric regression equation and root to shoot ratio used in the baseline scenario. The mean above and below ground carbon stock of the harvested trees is conservatively estimated to be the total emissions and to all enter the atmosphere.

c. Overview of data collection procedures

Data collection should follow best practices in PRA methodologies for assessing the land use practices of the communities within and surrounding the project area, as well as linkages with local forest resources. The fieldwork must characterize activities and practices causing emissions by extraction of wood for fuel, production of charcoal and timber production. The target population includes communities living within the project area (Cacheu and Cantanhez National Parks) and in a 2 km buffer zone. The questionnaires shall be applied on randomly selected households to identify potential for degradation activities related to energetic use for cooking (fuelwood and charcoal) and timber extraction.

If degradation practices are identified, fieldwork will be carried to collect data on new tree stumps and to estimate the likely DBH of the cut tree. The carbon stock quantification shall follow the same procedure used for the baseline definition according to CP-AB module.

Park guards (from the monitoring field team) will carry routine patrols; if illegal wood harvest activities are identified immediate action will be taken according to the law and internal park regulations. The activity shall be registered to ease the data collection to the monitoring of degradation.

d. Quality control and quality assurance procedure

The team conducting the PRA shall be properly trained and the sample randomly designed to avoid any bias. If degradation is detected, the same quality assurance and quality control procedures as detailed in the section for the updating estimates of forest carbon stocks will be adhered to in the field surveys of potential degradation areas.

e. Data archiving

Data will be archived permanently and maintained electronically by IBAP at its headquarter in Bissau. All originals field reports from the PRA shall be archived and the digital files kept. To safeguard its security, copies of the data should be stored at IBAP's headquarters under the responsibility of the head of monitoring and at the offices of each Park (Cacheu and Cantanhez) under the supervision of the parks' directors. The archiving of the data will be under the responsibility of the head of monitoring with the supervision of IBAP's director / program coordinator.

f. Organization and Responsibilities

The responsibility for each task of the illegal degradation monitoring shall be assigned based on the flowchart and table presented at the beginning of the monitoring section. The forest degradation monitoring report will be developed by the head of monitoring with the supervision and revision of IBAP's director or the Program Coordinator. The monitoring team that collects the data is responsible for data entry and compilation. The methods to collect the data and the databases will be verified by the advisory board before being submitted to the head of monitoring for compilation, data analysis and reporting.

4.3.3 Monitoring of Leakage Carbon Stock Changes

a. Technical Description of the monitoring task

Activities that deforestation agents would implement inside the project area in the absence of the REDD project activity that can be displaced outside the project boundary as a consequence of the implementation of the REDD project activity must be monitored. Where this displacement of activities increases the rate of deforestation, the related carbon stock changes and non-CO_2 emissions must be estimated and counted as leakage.

Activity-shifting leakage in the leakage belt will be monitored by tracking forest cover change in the leakage belt ($A_{Def,LK,u,i,t}$) using classified satellite imagery produced following the same procedures outlined in Section 4.3.2 referencing the forest cover benchmark map for the leakage belt.

b. Data to be collected

Using a Participatory Rural Appraisal (PRA) approach, randomly sample communities living within 2 km of the boundaries of the Leakage Belt and Project Area to estimate the proportion of the area deforested by immigrants ($PROP_{IMM}$ and $PROP_{RES}$) and local deforestation agents using the same approach as done for the definition of the baseline. This assessment must be repeated at least every 5 years and the estimated proportions will be assumed to be representative for up to five future years.

Leakage emissions from unplanned deforestation in the Leakage Belt is estimated by subtracting the emissions in the baseline from unplanned deforestation in the leakage belt ($\Delta C_{BSL,\ LK,\ unplanned}$) from the net GHG emission within the leakage belt in the project case in year t ($\Delta C_{P,\ LB}$). Parameters for forest carbon stock and carbon stocks in post deforestation land use in all pools are the same used in the baseline case, and shall be revised and updated with the baseline revision every ten years. The value of parameter, $PROP_{IMM}$, 9.3%, will be employed for the first five years of the project. Subsequently, the parameter, $PROP_{IMM}$, will be derived from the results of surveys conducted among neighbouring communities every < 5 years. Immigrants are defined as someone who has lived in the area less than 5 years and came from an area outside the leakage belt.

Activity shifting leakage outside the leakage belt will be tracked by monitoring deforestation in the project area ($A_{DefPA,i,t}$) and leakage belt ($A_{DefLB,i,t}$) using mid resolution imagery (e.g. Landsat TM and Enhanced TM+ (ETM+) collected to produce maps that support the leakage analysis.

c. Overview of data collection procedures

Mapping and Land Use Transition analysis should follow the procedures established in section 4.3.1, including pre-processing, classification and map validation. Every 5 years, the proportion of immigrants and local population living in the project area, leakage belt and within a 2 km buffer shall be collected following best practices in PRA methodologies for assessing the land use practices of the communities.

d. Quality control and quality assurance procedure

The map accuracy assessment shall be performed over the latest Forest/Non-Forest and latest Terrestrial Forest/Non-Forest/Mangrove map using an independent dataset and shall be performed each future monitoring. For the accuracy assessment, a sampling strategy based on a 250x250 meter systematic grid of points with a random origin, created over the entire Guinea-Bissau territory. This grid shall be used as a basis for plot location for the four forest classes, (Closed forest, Open forest, Savanna Woodland and Mangrove) which will be grouped to validate the Forest/non- Forest and Forest/Non-Forest/Mangrove map. In addition, Non-Forest data shall be collected over very high-resolution data like Google Earth and used to confirm the validation. The confusion matrices provide the basis on which to both describe classification accuracy and characterize errors (Foody, 2002).

The PRA should be designed randomly avoiding bias in the community sampling. The minimum sample size is 10% of communities living within 2 km of the boundaries of the leakage belt and project area. If 10% is less than 10 communities then the sample size shall be set as 10 or 100% of the communities. If 10% is more than 30 communities then the sample size shall be set as 30.

The team conducting the PRA shall be properly trained. SOPs must be presented and discussed between the monitoring field team and the head of monitoring, with the support of the advisory board. Technical review or pre-verification of the data, check-list to assess that SOPs were followed, and revision of the monitoring report will be conducted by the advisory board and the head of monitoring.

e. Data archiving

Data will be archived and maintained electronically by IBAP at its headquarter in Bissau under the responsibility of the head of monitoring and at the offices of each Park (Cacheu and Cantanhez) under the supervision of the parks' directors. All data sources and processing, classification and change detection will be documented and stored. PRA field reports must also be maintained in the original hard copies and electronically (digitalized). Data to be archive must include raw imagery, ancillary cartographic data used, data used for training the classification, software version applied, classified images, data used for ground thruthing, final accuracy assessment matrix, PRA sample design and field reports.

f. Organization and Responsibilities

The responsibility for the leakage carbon stock changes monitoring shall be assigned based on the flowchart and table presented at the beginning of the monitoring plan. Leakage emissions report will be developed by the head of monitoring with the supervision and revision of IBAP's director or the program coordinator.

4.3.4 Updating forest carbon stock estimated

Forest carbon stock used to calculate emissions will use estimates derived from field measurements less than or equal to 10 years old. In the event that any deforestation is reported, forest carbon stock estimates older than 10 years will be updated for any strata where deforestation is detected (including deforestation resulting from natural disturbances). The same stratification used for the initial baseline (compatible official/government publications) will be used unless significant difference in carbon stock or impacts of natural disturbances are detected. In that case, a given stratum may be further stratified based on post-natural disturbance carbon stocks. Initial above and belowground biomass stock estimates from the 2011 inventory are valid and treated as constant through 2021, after which they will be re-estimated from new field measurements.

a. Technical Description of the monitoring task

This section presents the methodology applied for the carbon stocks estimation for above- and below-ground biomass. This shall be replicated in every baseline update. Sampling shall be designed to accurately account for the total biomass carbon stocks in the selected carbon pools and stratified using ancillary data provided from satellite imagery and following VMD0016 (X-STR). The carbon pools assessed for the baseline were defined based on VM0007 and on factors described in further detail below.

b. Data to be collected

The carbon pools estimated in this project are: live vegetation above- and below-ground tree biomass. The above- and below-ground tree biomass carbon was estimated for the existing vegetation at “time zero” in the following strata:

- Closed Forests
- Open Forests
- Mangroves
- Savannah

c. Overview of data collection procedures

To re-assess forest carbon stock, a minimum sample size will be defined to comply with the desired statistical precision according to the CP-AB module (i.e. 95% confidence interval is within 15% of the mean) and the maximum uncertainty according to X-UNC. The sample design can benefit from known variability of biomass data of previous projects and the baseline study to comply with the target error level of 15% (CI 95%).

A 250 x 250 meter systematic grid of points with a random origin shall be created. The number of plots to be sampled in each stratum are determined based on three considerations: (1) the variability of biomass within a stratum (evaluated using previously collected data); (2), the estimated area covered by each stratum; and (3) the target precision level (set at 15%, 95% CI). Sample plots are then randomly selected for each stratum that were deforested and need to be revised over the grid. Selected plot coordinates shall be loaded into GPS equipment and later used in the field to reach the center of each plot.

At the plot level, the following data shall be recorded: geographic coordinates (with GPS), physiographic location, dominant aspect, and slope. At the stand level, data to be recorded include the classification of the forest type, tree crown cover, forest degradation factors (soil erosion, illegal logging and burning practices, etc.). At tree level, species shall be identified; tree vitality classified, and diameter at breast height (DBH, as shown in the figure below), total height, top and basal diameter of dead trees and stem height of palm-trees (H) shall be measured.

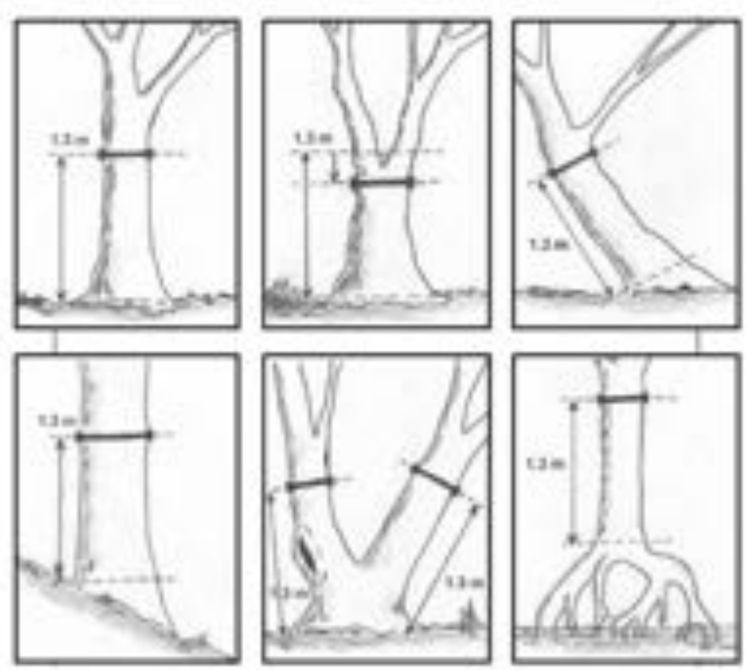


Figure 15. Schematic representation of location on tree where DBH was measured. Pearson et al. (2005)

All trees with DBH of ≥5 cm and a minimum height (H) of 1.3 m are considered for measurement in the nested plots. To be representative of all sizes of tree present in sampled parks in GB, measured tree dimensions varied between different forest types. Dimensions of Open Forest and Savanna plots and diameter classes measured in each nest are shown in the schematic diagram below.

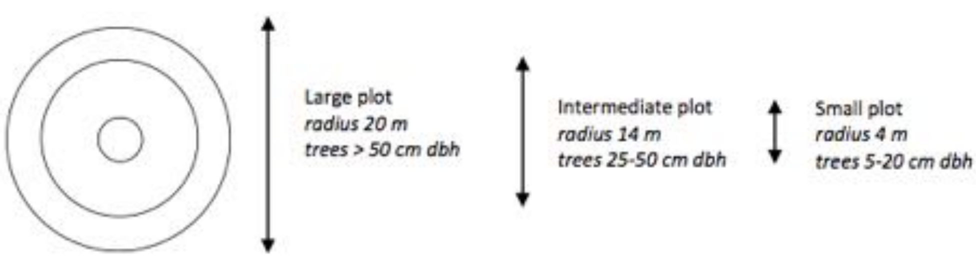


Figure 16. Schematic diagram representing an Open Forest and Savanna circular nested plot

Dimensions of mangrove nested plots followed the format of the schematic diagram presented in Figure 15.

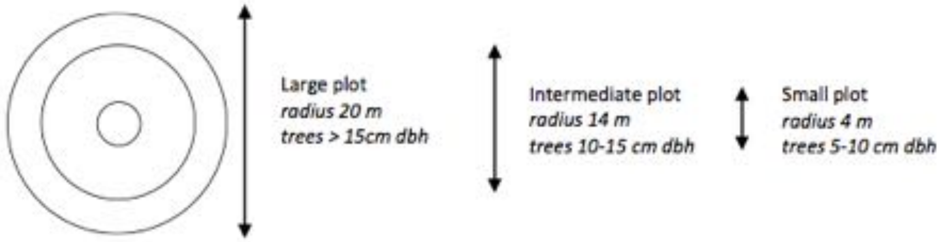


Figure 17. Schematic diagram representing a Mangrove circular nested plot

Parameters relevant for C stock estimation measured for each vegetation formation are summarized in Table 15 below.

Table 27. Parameters measured in different vegetative formation for the baseline analysis

Vegetation formation	Parameter measured	Stratum
Mangrove trees	DBH	- Mangroves
Palm trees	Height	- Closed-forest - Open-forest - Savannas
Trees	DBH and Height	- Closed-forest - Open-forest - Savannas

Data collected in the field and analysed at the nested plot level shall be converted to carbon and extrapolated to the area of a full hectare to produce carbon stock estimates. Extrapolation occurs by calculating the proportion of a hectare (10,000 m^2) that is occupied by a given plot (or nest in this case) using a scaling factor.

Aboveground biomass (AGB) in terrestrial forest and mangroves will be estimated applying the allometric equation of Chave et al 2005 and maintain consistency with analytical procedures applied in the original inventory. AGB in palm forest will be estimated applying the allometric equation of Delaney et al 1999 and maintain consistency with the analytical procedures applied in the original inventory.

The below-ground biomass (BGB) of trees was estimated using a linear relationship between root biomass and shoot biomass reported by Mokany et al. (2006). The authors developed a root to shoot ratio (RSR) for many different types of vegetation and the relationship reported for tropical dry forest was chosen based on IPCC (1996). The relationship establishes that:

- if AGB < 20 t ha^{-1}, BGB (t ha^{-1}) = 0.56 * AGB; or
- if AGB > 20 t ha^{-1}, BGB (t ha^{-1}) = 0.28 * AGB

For Palm Trees, to the Project Proponent knowledge there is no dataset available or published that relate above- to below- ground biomass for palm trees. Therefore, conservatively, belowground carbon stocks of palm trees are omitted.

BGB is of particular importance in mangroves because mangrove trees accumulate significant portion of its biomass in the roots (Komiyama et al., 2008). However, no root-to-shoot ratios for African mangrove forests were found in the literature. To estimate BGB in mangroves, we compiled AGB and BGB data reported by Komiyama et al. (2008) (including data for Indonesia, Australia, Thailand, Panama, and Puerto Rico) and an average RSR of 0.61 was calculated across all available values. Table 13 depicts the compilation of the data based on AGB and BGB reported by Komiyama et al. (2008).

Table 28. Global mangrove AGB and BGB for estimation of RSR for mangrove forests in Guinea-Bissau

Region	Forest type	AGB (t ha^{-1})	BGB (t ha^{-1})	RSR
Indonesia (Halmahera)	*B. gymnorrhiza*	436.4	180.7	0.41
Indonesia (Halmahera)	*B. gymnorrhiza*	406.6	110.8	0.27
Indonesia (Halmahera)	*R. apiculata*	356.8	196.1	0.55
Australia	*A. marina*	341.0	121.0	0.35
Thailand (Ranong Southern)	*Rhizophora spp.*	298.5	272.9	0.91
Indonesia (Halmahera)	*R. apiculata*	299.1	177.2	0.59
Thailand (Ranong Southern)	*Rhizophora spp.*	281.2	117.6	0.42
Thailand (Ranong Southern)	*B. gymnorrhiza*	281.2	106.3	0.38
Thailand (Ranong Southern)	*Sonneratia spp.*	281.2	68.1	0.24
Indonesia (Halmahera)	*R. apiculata*	216.8	98.8	0.46
Indonesia (Halmahera)	*R. stylosa*	178.2	94.0	0.53
Indonesia (Halmahera)	*Sonneratia spp.*	169.1	38.5	0.23
Australia	*A. Marina*	144.5	147.3	1.02
Thailand (Trat Eastern)	Mixed forest	142.2	50.3	0.35
Australia	*A. marina*	112.3	160.3	1.43
Thailand (Satun Southern)	*C. tagal*	92.2	87.5	0.95
Thailand (Southern Pang-nga)	Mixed forest	62.2	28.0	0.45
Panama	*Rhizophora spp*	279.2	306.2	1.10
Puerto-Rico	*R. mangle*	62.9	64.4	1.02
Average values		**233.8**	**127.7**	**0.61**

d. Quality control and quality assurance procedure

The following steps will be taken to control for errors in field sampling and measurements and data analysis:

1. Field crews with prior training in forest inventory will carry out all field data collection and adhere to field measurement protocols. Pilot sample plots shall be measured before the initiation of formal measurements to train and appraise field crews and identify and correct any errors in field measurements. The head of monitoring will be responsible for ensuring that field protocols are followed by the monitoring field team to ensure accurate and consistent measurement and for identifying training requirements.

2. To ensure accurate measurements, the height of diameter at breast height (1.3 m) will be periodically re-assessed by personnel during the course of the inventory. Field crews will have fine scale forest strata maps for use in the field to precisely interpret strata/forest boundaries and identify potential areas of plot overlap.

3. Calibration of hypsometers will be confirmed prior to formal field measurements daily before the team leaving for the field. All borderline trees will be measured and assessed against hypsometer plot radius factor (accounting for slope) according to the field measurement protocol.

4. Field measurement data will be recorded on standard field data sheets, digitalized for records and transferred to electronic media following each return from the field.

5. Checks will be run for unusual (high or low) values to identify and correct any errors in recorded field data or transcription. Personnel involved in data analysis will consult with personnel involved in measurement to clarify any ambiguities in recorded field data.

6. If wood density analysis is necessary, all balances for measuring dry weights will be calibrated against known weights prior to use. All calibration results will be documented and archived along with sample analysis results.

7. Register all field members and their specific responsibilities in each field sheet

8. Compare data from the GPS equipment with the coordinates in the field datasheet and in the excel workbook to identify and correct eventual data entry errors.

9. Technical review or pre-verification of the data will be conducted by the head of monitoring and the advisory board

e. Data archiving

Original data sheets will be permanently archived at IBAP office and the electronic database of all field measurements will be housed in the dedicated long-term electronic archive maintained on IBAP office (external HD). The electronic database will also archive GIS coverage, detailing forest and strata boundaries and plot locations. To safeguard its security, copies of the data should be stored at IBAP's headquarters under the responsibility of the head of monitoring and at the offices of each Park (Cacheu and Cantanhez) under the supervision of the parks' directors. The archiving of the data will be under the responsibility of the head of monitoring with the supervision of IBAP's director / program coordinator.

f. Organization and Responsibilities

The responsibility for each task of carbon stock update shall be assigned based on the flowchart and table presented at the beginning of the monitoring plan. The carbon stock update report will be developed by the head of monitoring with the supervision and revision of IBAP's director or the program coordinator.

5 ENVIRONMENTAL IMPACT

The Project anticipates positive environmental impacts on the forest and biodiversity. Both Cantanhez and Cacheu Parks represent globally significant habitats that will be effectively protected. Cacheu National Park is the fifth largest contiguous mangrove ecosystem in Africa. The area plays an important role both in the conservation of maritime biodiversity and terrestrial biodiversity receiving numerous species of migratory birds during the winter. The complex of estuarine mangroves, swamp and marshland are of great importance to Palaearctic waders, waterfowls and birds of prey. Cantanhez Forest National Park holds one of the few remaining stands of primary sub-humid Guinea forest and is home to the endangered chimpanzee, Colobus, Manatees and Marine Turtles.

The Project also relies on a participatory management structure safeguarding the local community livelihoods and preserving access to the valuable natural resources whilst providing funding through FIAL to the establishment of long-term sustainability practices in agriculture and extraction activities. As part of the establishment of CBMP an Environmental and Social Impact Analysis was conducted assuring stakeholders awareness and support for the project. Such analysis has been publicly disclosed in Guinea-Bissau and is available through the World Bank and IUCN. In general the Project will contribute to:

- long term financing of globally significant habitats under effective protection;
- improved conservation of globally significant fauna and flora species and assemblages within and outside the Project Area;
- strengthened protection for globally and regionally significant species, including marine turtles, African manatees, chimpanzees, sharks, sea-going hippopotami, migratory birds and colobus monkeys;
- improved sustainability of regionally important fisheries through the better management of critical breeding grounds and nurseries;
- decreased loss and degradation of critical coastal habitats and ecosystems, with associated benefits for conservation of endangered and threatened species and for the productivity of regionally significant fisheries;
- development of practical models for guiding participatory biodiversity management elsewhere in the region;
- demonstrate that carbon finance can provide tangible financial benefits for forest conservation.

6 STAKEHOLDER COMMENTS

The REDD project builds upon the participatory process launched under the CBMP. As such it is based on a long tradition of stakeholder consultation and participation, beginning with the highly participatory identification and design of the CBMP, and continuing throughout its implementation phase and that of the follow on initiatives. In addition to the broad consultations, and in line with World Bank safeguard policies, a team of social and environmental specialists specifically visited the parks and met with target populations, as well as other key stakeholders (local authorities, NGOs, etc.). This led to the preparation of an Environmental and Social Assessment of the proposed projects' activities, an Environmental and Social Management Framework designed to guide any future activities, especially those under the FIAL; a Process Framework, designed to guide consultations on activities which might give rise to restrictions of access to resources. As a precautionary measure the government also prepared a Resettlement Process Framework, providing guidance on how to address involuntary resettlement situations. (This last has not been an issue since Guinea Bissau law permits people to reside within protected areas, and relocation has never been considered.) Each of these CBMP documents were discussed publicly by a cadre of experts, and amended thereafter, and the target population in the project zone was informed via community and regional radio stations about the project and possible environmental and social impacts.

Further, key stakeholders, especially local communities, public authorities and NGOs have been heavily involved in protected area management. There is also ongoing consultation and discussion with communities and other stakeholders through the bi-annual Park Management Committees, of which they form 50 percent, and through which management decisions are taken and enforced. These Committees are also key to the FIAL process, prioritizing community roll out, and reviewing and ensuring microprojects fit with the resource conservation objectives.

Consultations specific to the REDD financing have also been conducted, with the objective to help stakeholders understand the REDD concept and get feedback on the design of this initiative.

The consultations mainly relied on workshops, seminars, a radio broadcast and meetings with governmental personnel, including the State Secretary of Environment and Sustainable Development. The workshops and seminars included IBAP, the local community and NGOs and were held in Cantanhez and Cacheu. The main meetings are presented below.

List of all meetings and workshops planned (9-29 February, 2012)

09/02/2012 IBAP, Bissau – meeting
11/02/2012 São Domingos, PNTC – workshop theoretical component
11-13/02/2012 São Domingos, PNTC – workshop practical component
14/02/2012 IBAP, Bissau – REDD seminar with major stakeholders

14/02/2012 AD, Bissau – meeting with Carlos Schwarz da Silva (NGO AD)
15/02/2012 Iemberém, Cantanhez – interview broadcast in Radio Lamparam
16-23/02/2012 Cantanhez – workshop practical component
23-27/02/2012 Cacheu – meeting with Fernando Biag and workshop (practical component)
28/02/2012 SEAD, Bissau – meeting with the State Secretary Mário Dias Sami
29/02/2012 IBAP, Bissau – Final meeting

09/02/2012 IBAP, Bissau

Participants: Mr. Alfredo Simão da Silva (Director of IBAP) Ms. Tanya Yudelman Bloch (World Bank) Ms. Maria Vasconcelos (IICT) Mr. Luis Catarino (IICT) Ms. Joana Melo (RSET)

Field campaign preparatory meeting between IICT/RSET technical team, the representative of the funding agency (World Bank), and IBAP's Director. Discussion of the REDD Project Activities in an informal setting. Organization of the seminar, including setting the day for the project presentation (February 14th) and selection of major stakeholders to be invited.

11-13/02/2012 São Domingos, PNTC

This workshop was structured into a theoretical and practical component. The theoretical component took place on February 11th at IBAP's facilities in São Domingos (PNTC) and was on the basis of the whole training program to IBAP staff working in the carbon stock field work that would extend until the end of the month. The instructors from IICT/RSET had the support of Viriato Cassamá (SEADD) who made the translation to Creole. The theoretical class allowed the participants to have a general understanding of the REDD mechanism and how the quality of the fieldwork is fundamental for the project success. After the main session and before division of the participants into two teams – the mangrove and the terrestrial forest teams – the maps were presented and the equipment introduced. The members of the two teams installed and measured the first three plots together to ensure that all participants were familiar with the field protocol and equipment.

Instructors: Ms. Maria Vasconcelos (IICT) Mr. Luís Catarino (IICT) Ms. Joana Melo (RSET)

Participants: Mr. Viriato Cassamá (SEADD) Mr. Antão da Costa (SEADD) Mr. Sadjo Danfa (IBAP) Mr. António da Silva (IBAP) Mr. Nélson Justino Gomes (SEADD) Mr. Fernando Indami (SEADD) Mr. Joãozinho Mané (IBAP) Mr. Santos Mendes (IBAP – PNTC Park guard)

14/02/2012 IBAP, Bissau – REDD seminar with major stakeholders

The meeting was cancelled. Unfortunately and unexpectedly the seminar had to be cancelled. The main stakeholders invited to this session included: SEADD - Ministerio da Agricultura (Direcção Geral das Florestas e Caça, DG da Agricultura) - Ministério da Economia e Plano

(Direcção Geral do Plano) - IBAP - UICN - Gabinete de Planificação Costeira - ONGs (AD and Tininguena) - Direcção Geral das Alfandegas (Guardas Fiscais) - CAIA

Although the conference had to be canceled, the presentation was made available to the stakeholders invited.

14/02/2012 AD, Bissau

Meeting with Carlos Schwarz da Silva, Executive Director of the NGO Acção para o Desenvolvimento (AD) at the AD headquarters in Bissau.

Participants: Mr. Carlos Schwarz da Silva Mr. Viriato Cassamá (SEADD) Ms. Maria Vasconcelos (IICT) Mr. Luís Catarino (IICT) Ms. Joana Melo (RSET)

15/02/2012 Iemberém, Cantanhez

After the arrival at the IBAP facilities at the Cantanhez Park a reporter from the local radio station (Radio Lamparam) interviewed Luís Catarino and Viriato Cassama (who spoke in Creoule) to explain to the local population the work that the field crew would be doing there during the next few days. The benefits for the local populations from a future REDD project in the park were also highlighted. This broadcast was very useful for the terrestrial forest team. As the population in each tabanca was already informed of the work in progress they were very cooperative and helpful when needed.

16-23/02/2012 Cantanhez

Revision of the theoretical concepts (including the sampling methodology), and equipment functioning. Re-adjustment of the field teams.

Instructors: Ms. Maria Vasconcelos (IICT) Mr. Luís Catarino (IICT) Ms. Joana Melo (RSET)

Participants: Mr. Viriato Cassamá (SEADD) Mr. Nélson Justino Gomes (SEADD) Mr. Fernando Indami (SEADD) Mr. Joãozinho Mané (IBAP) Mr. António Pansau Ndafá (SEADD) Mr. Mutaru Cumpó (Cantanhez park guard) Mr. Tchutchu Indami (Cantanhez park guard)

23-27/02/2012 Cacheu

Meeting with Fernando Biag (PNTC Director) for exchanging of ideas about the park and presentation of the project. Fernando Biag was very enthusiastic about the future prospects of the project and joined the field work teams.

Instructors: Ms. Maria Vasconcelos (IICT) Mr. Luís Catarino (IICT) Ms. Joana Melo (RSET)

Participants: Mr. Fernando Biag (IBAP) Mr. Nélson Justino Gomes (SEADD) Mr. Fernando Indami (SEADD) Mr. António Pansau Ndafá (SEADD) Mr. Luís Gomes (IBAP)

28/02/2012 SEAD, Bissau

Meeting with the State Secretary Mário Dias Sami to present the project, its activities, background and future prospects of the REDD mechanism.

Participants: Mr. Mário Dias Sami (SEADD) Mr. Viriato Cassamá (SEADD) Ms. Maria Vasconcelos (IICT) Ms. Joana Melo (RSET)

29/02/2012 IBAP, Bissau

Wrap-up meeting at IBAP's headquarters, Bissau. The objective of this meeting was to somehow substitute the canceled seminar. The project team had the chance to meet and discuss the ongoing project with part of IBAP's staff and give an overview of its background in an international setting (i.e., the REDD mechanism). This meeting also promoted some share of information and the linkage between the parks management during the past years and the forest dynamics observed in the maps produced using time-series of remote sensing imagery.

Participants:- Mr. Alfredo Simão da Silva (IBAP) - Ms. Aissa Regala (IBAP) - Mr. António da Silva (IBAP) - Mr. Maurício Insumbu (IBAP) - Mr. Sadjo Danfa (IBAP) - Mr. Viriato Cassamá (SEADD) - Ms. Maria Vasconcelos (IICT) - Mr. Luís Catarino (IICT) - Ms. Joana Melo (RSET)

All comments received were duly evaluated and discussed at the meetings, workshops and seminars. The continued communication of the REDD project activity will be carried by IBAP at the bi-annual Park Management Committee meetings.

APPENDIX 1: NON-PERMANENCE RISK REPORT

1 INTERNAL RISK

Project Management		
Risk Factor	Risk Factor and/or Mitigation Description	Risk Rating
a)	Species planted (where applicable) associated with more than 25% of the stocks on which GHG credits have previously been issued are not native or proven to be adapted to the same or similar agro-ecological zone(s) in which the project is located. (**Not applicable**)	0
b)	On going enforcement to prevent encroachment by outside actors is required to protect more than 50% of stock Risk on which GHG credits have previously been issued. (**Not applicable**)	0
c)	Management team does not include individuals with significant experience in all skills necessary to successfully undertake all project activities (i.e., any area of required experience is not covered by at least one individual with at least 5 years experience in the area). The project managed team holds two professionals with 10+ years of experience in conservation, park management, community engagement and agriculture. The CVs, in French, of Dr. Justino Biai and Alfredo Simão clearly demonstrate the necessary experience to successfully manage the project.	0
d)	Management team does not maintain a presence in the country or is located more than a day of travel from the project site, considering all parcels or polygons in the project area. IBAP maintains and operates one office on each park included in the project activity (Cacheu and Cantanhez). On each office, there is a local team composed of, inter alia, a Park Director, Specialists and Park Guards. The presence is also supported by the continued engagement with the community and the participation of the local population on the park management committee.	0
e)	**Mitigation**: Management team includes individuals with significant experience in AFOLU project design and implementation, carbon accounting and reporting (e.g., individuals who have successfully managed projects through validation, verification and issuance of GHG credits) under the VCS Program or other approved GHG programs. (**Not applicable**)	0
f)	**Mitigation**: Adaptive management plan in place. (**Not applicable**)	0
Total Project Management (PM) [as applicable, (a + b + c + d + e + f)] Total may be less than zero.		0

Financial Viability		
Risk Factor	Risk Factor and/or Mitigation Description	Risk Rating
a)	Project cash flow breakeven point is greater than 10 years from the current risk assessment (**Not applicable**)	0
b)	Project cash flow breakeven point is between 7 and up to less than 10 years from the current risk assessment (**Not applicable**)	0
c)	Project cash flow breakeven point between 4 and up to less than 7 years from the current risk assessment (**Not applicable**)	0
d)	Project cash flow breakeven point is less than 4 years from the current risk assessment As demonstrated in the file RISK_REDD_20140622.xlsx (worksheet Cashflow_REDD) the project has a positive return on year 02, therefore breakeven point is less than 4 years. Park management costs are derived from Vreugdenhil (2007) the article is being provided to SCS (Vreugdenhil_2007_COST_IBAP.pdf). Other costs related to the VCS process, including validation, verification, levy and registries are based on public available information and on the current VVB contract with the project proponent. Revenues are calculated based on Ecosystem Marketplace (2012) on the state and trends of the voluntary carbon market. Finally, the cash flow arbitrarily establishes that 30% of the REDD revenues are channelled direct to the communities through the benefit sharing mechanism (FIAL).	0
e)	Project has secured less than 15% of funding needed to cover the total cash out before the project reaches breakeven (**Not applicable**)	0
f)	Project has secured 15% to less than 40% of funding needed to cover the total cash out required before the project reaches breakeven (**Not applicable**)	0
g)	Project has secured 40% to less than 80% of funding needed to cover the total cash out required before the project reaches breakeven (**Not applicable**)	0
h)	Project has secured 80% or more of funding needed to cover the total cash out before the project reaches breakeven IBAP is receiving support from the World Bank and the GEF. The VCS costs are being fully covered by this international support. For park management costs, GEF 5 is supporting IBAP with USD 2.95 million in a four-year grant to support the network of protected areas (SNAP). Further detail on the GEF 5 disbursement to the country can be found at http://qa-gef-wb.reisys.com/new-country-profile?countryCode=GW demonstrating that, in total, Guinea Bissau will receive USD 4,6 million, from which USD 1,5 million are focused on biodiversity and USD 2,0 million on Climate Change.	0
i)	**Mitigation**: Project has available as callable financial resources at least 50% of total	0

	cash out before project reaches breakeven. (**Not applicable**)	
Total Financial Viability (FV) [as applicable, ((a, b, c or d) + (e, f, g or h) + i)] Total may not be less than zero.		**0**

Opportunity Cost		
Risk Factor	Risk Factor and/or Mitigation Description	Risk Rating
a)	NPV from the most profitable alternative land use activity is expected to be at least 100% more than that associated with project activities; or where baseline activities are subsistence-driven, net positive community impacts are not demonstrated. (**Not applicable**)	0
b)	NPV from the most profitable alternative land use activity is expected to be between 50% and up to100% more than from project activities (**Not applicable**)	0
c)	NPV from the most profitable alternative land use activity is expected to be between 20% and up to 50% more than from project activities (**Not applicable**)	0
d)	NPV from the most profitable alternative land use activity is expected to be between 20% more than and up to 20% less than from project activities; or where baseline activities are subsistence-driven, net positive community impacts are demonstrated. As demonstrated in the baseline assessment, the main deforestation driver is the small scale, subsistence-driven, traditional agricultural practices. In addition, the project provides net positive community impacts.	0
e)	NPV from project activities is expected to be between 20% and up to 50% more profitable than the most profitable alternative land use activity (**Not applicable**)	0
f)	NPV from project activities is expected to be at least 50% more profitable than the most profitable alternative land use activity (**Not applicable**)	0
g)	**Mitigation:** Project proponent is a non-profit organization (**Not applicable**)	0
h)	**Mitigation:** Project is protected by legally binding commitment to continue management practices that protect the credited carbon stocks over the length of the project crediting period (see project longevity) (**Not applicable**)	0
i)	**Mitigation:** Project is protected by legally binding commitment to continue management practices that protect the credited carbon stocks over at least 100 years (see project longevity) The parks are protected areas, legally established (Decrees 12/2000 and 14/2001). Further, both have Internal Regulations formally approved by the parks management committee. Both the laws and internal regulations had been provided to SCS.	-8
Total Opportunity Cost (OC) [as applicable, (a, b, c, d, e or f) + (g or h)] Total may not be less than 0.		0

Project Longevity		
a)	Without legal agreement or requirement to continue the management practice (**Not applicable**)	0
b)	With legal agreement or requirement to continue the management practice The parks are protected areas, legally established (Decrees 12/2000 and 14/2001). Further, both have Internal Regulations formally approved by the parks management committee. Both the laws and internal regulations had been provided to SCS.	-20
Total Project Longevity (PL) May not be less than zero		**0**

Internal Risk	
Total Internal Risk (PM + FV + OC + PL) Total may not be less than zero.	**0**

2 EXTERNAL RISKS

Land and resource tenure		
Risk Factor	Risk Factor and/or Mitigation Description	Risk Rating
a)	Ownership and resource access/use rights are held by same entity(s) (**Not applicable**)	0
b)	Ownership and resource access/use rights are held by different entity(s) (eg, land is government owned and the project proponent holds a lease or concession) The parks are public property; no private land rights exist in Guinea Bissau. Land belongs to the government and is managed by IBAP. Communities, by tradition, have rights over resources access and use. At community level, the elder defines resources share and access to standing forests. The Land Law clearly defines that ownership is not allowed but recognizes the consuetudinary rights of communities over land use and resource access. The land law and the protected area law demonstrating this situation had been provided to SCS.	2
c)	In more than 5% of the project area, there exist disputes over land tenure or ownership (**Not applicable**)	0
d)	There exist disputes over access/use rights (or overlapping rights)	0

	Traditional culture establishes, for example, how land is passed in a family over the years, the role of male and female in the community and how sacred location are defined and protect. No disputes over access or overlapping rights exist.	
e)	WRC projects unable to demonstrate that potential upstream and sea impacts that could undermine issued credits in the next 10 years are irrelevant or expected to be insignificant, or that there is a plan in place for effectively mitigating such impacts (**Not applicable**)	0
f)	**Mitigation:** Project area is protected by legally binding commitment (eg, a conservation easement or protected area) to continue management practices that protect carbon stocks over the length of the project crediting period The parks are protected areas, legally established (Decrees 12/2000 and 14/2001). Further, both have Internal Regulations formally approved by the parks management committee. Both the laws and internal regulations had been provided to SCS.	-2
g)	**Mitigation**: Where disputes over land tenure, ownership or access/use rights exist, documented evidence is provided that projects have implemented activities to resolve the disputes or clarify overlapping claims (**Not applicable**)	0
Total Land Tenure (LT) [as applicable, ((a or b) + c + d + e+ f)] Total may not be less than zero.		**0**

Community Engagement		
Risk Factor	Risk Factor and/or Mitigation Description	Risk Rating
a)	Less than 50 percent of households living within the project area who are reliant on the project area, have been consulted	0
b)	Less than 20 percent of households living within 20 km of the project boundary outside the project area, and who are reliant on the project area, have been consulted For the establishment of the CBMP, IBAP performed a census that included households outside the Parks (Project Area) that could be impacted by the project. After understanding the potential impacts of protecting Cacheu and Cantanhez, FIAL, which was the micro project financial support instrument part of the CBMP, was extended to communities living outside Cacheu and Cantanhez. However, the project proponent cannot quantify the percentage of households consulted, therefore the most conservative value was selected.	5
c)	**Mitigation**: The project generates net positive impacts on the social and economic wellbeing of the local communities who derive livelihoods from the project area	-5

	The main project component to reduce deforestation relies on community engagement and support. The project will protect the standing forest by generating net positive impacts on the social and economic wellbeing of the local communities through technical support and training, efficiency gains in agricultural production, support to alternative income generation activities, and so forth. Moreover, the benefit sharing mechanism, similar to FIAL, will guarantee that micro projects relevant to communities are financed.	
Total Community Engagement (CE) [where applicable, (a+b+c)] Total may be less than zero.		**0**

Political Risk		
Risk Factor	Risk Factor and/or Mitigation Description	Risk Rating
a)	Governance score of less than -0.79 The Worldwide Governance Indicator (WGI) was used to calculate the aggregate governance score. GB totaled a negative score of -1.02. The file RISK_REDD_20140622.xlsx presents (worksheet WGI_GB) the detailed calculation of the index.	6
b)	Governance score of -0.79 to less than -0.32 (**Not applicable**)	0
c)	Governance score of -0.32 to less than 0.19 (**Not applicable**)	0
d)	Governance score of 0.19 to less than 0.82 (**Not applicable**)	0
e)	Governance score of 0.82 or higher (**Not applicable**)	0
f)	**Mitigation:** Country implementing REDD+ Readiness or other activities such as: a) The country is receiving REDD+ Readiness funding from the FCPF, UN-REDD or other bilateral or multilateral donors b) The country is participating in the CCBA/CARE REDD+ Social and Environmental Standards Initiative c) The jurisdiction in which the project is located is participating in the Governors' Climate and Forest Taskforce d) The country has an established national FSC or PEFC standards body e) The country has an established DNA under the CDM and has at least one registered CDM A/R project (**Not applicable**)	0
Total Political (PC) [as applicable ((a, b, c, d or e) + f)] Total may not be less than zero.		**6**

External Risk	
Total External Risk (LT + CE + PC) Total may not be less than zero.	**6**

3 NATURAL RISKS

Natural Risk – Fire	
Significance	Insignificant
Likelihood	Unlikely – natural fire does not occur in the project area. No registration could be found on such natural risk event
Score (LS)	0 (**Not applicable**)
Mitigation	Not applicable

Natural Risk – Pest and Disease outbreaks	
Significance	Insignificant
Likelihood	Unlikely – the project proponent could not find registration of pest and diseases outbreaks in the project area.
Score (LS)	0 (**Not applicable**)
Mitigation	Not applicable

Natural Risk – Extreme Weather	
Significance	Insignificant
Likelihood	Unlikely – there are no records of extreme weather events in the project area
Score (LS)	0 (**Not applicable**)
Mitigation	Not applicable

Natural Risk – Geological Risks	
Significance	Insignificant – Guinea Bissau is not subject to geological events like earthquakes.
Likelihood	Unlikely – Guinea Bissau is not subject to geological events like earthquakes.
Score (LS)	0 (**Not applicable**)
Mitigation	Not applicable

Natural Risk – Other natural risk	
Significance	Not applicable
Likelihood	Not applicable
Score (LS)	Not applicable
Mitigation	Not applicable

Score for each natural risk applicable to the project (Determined by (LS × M)	
Fire (F) (**Not applicable**)	0

Pest and Disease Outbreaks (PD) (**Not applicable**)	0
Extreme Weather (W) (**Not applicable**)	0
Geological Risk (G) (**Not applicable**)	0
Other natural risk (ON) (**Not applicable**)	0
Total Natural Risk (as applicable, F + PD + W + G + ON)	**0**

Total Natural Risk (F + PD + W + G + ON)	**0.00**
Note: Total may not be less than zero If the Total Natural Risk is above 35 then the project fails the entire risk analysis	

4 OVERALL NON-PERMANENCE RISK RATING AND BUFFER DETERMINATION

4.1 Overall Risk Rating

Risk Category	Rating
a) Internal Risk	**0**
b) External Risk	**6**
c) Natural Risk	**0**
Overall Risk Rating (a + b + c)	**10**
Note: Overall risk rating shall be rounded up to the nearest whole percentage The minimum risk rating shall be 10, regardless of the risk rating calculated If the overall risk rating is over 60 then the project fails the entire risk analysis	

Since the risk score cannot be lower than 10 the project assigns a total score of 10 for the Non-Permanence Risk Rating.

4.2 Calculation of Total VCUs

Years	Estimated net GHG emission reductions or removals (tCO2e)	Risk buffer	Deductions for AFOLU pooled buffer account	Net Total (tCO2e)
2013	75,251	10%	9,582	65,670
2014	153,844	10%	19,589	134,254
2015	235,776	10%	30,022	205,755
2016	321,050	10%	40,880	280,170

2017	409,664	10%	52,163	357,501
2018	501,619	10%	63,872	437,747
2019	596,914	10%	76,006	520,908
2020	695,550	10%	88,566	606,985
2021	797,527	10%	101,550	695,977
2022	902,845	10%	114,961	787,884
2023	978,096	10%	124,543	853,554
2024	1,056,688	10%	134,550	922,139
2025	1,138,621	10%	144,982	993,639
2026	1,223,895	10%	155,840	1,068,054
2027	1,312,509	10%	167,124	1,145,385
2028	1,404,464	10%	178,833	1,225,631
2029	1,499,759	10%	190,967	1,308,792
2030	1,598,395	10%	203,526	1,394,869
2031	1,700,372	10%	216,511	1,483,861
2032	1,805,690	10%	229,921	1,575,768
Total	18,408,530	10%	2,343,988	16,064,542

APPENDIX 2: WOOD DENSITY INFORMATION

SPECIES CODE	SPECIES	COMMON NAMES	COMMON NAMES	FAMILY	WOOD DENSITY	SOURCE
Aca_mac	Acacia macrostachya Rchb. ex DC.	pau-de-ferida, pau-ferida	gáudè, tanda-sara (ff); bula-bali, bule, búrlé, quide, tchide (fu).	Leguminosae/ Mimosoideae	0.759	Nygard & Elfving 2000
Ada_dig	Adansonia digitata L.	Calabacera	látè (ba); uáto (bj); cabaceira, cabacera; baobab, pain de singe (o fruto) (fr); bóè (fu); bedom-hal, burungule-burúnque (mc); citô (md); bebáque, bedom-hal, brungal (mj); m'béke (nl); burungule (pp);	Bombacaceae	0.32	

			cabaceira, calabaceira (pt); kiri (ss).			
Afz_afr	Afzelia africana Sm. ex Pers.	pau-conta, pó-de-conta	biiguê, pega (ba); aru, oru (cs); lengue, lénguei (ff); lengueje, leoncó, luengue (fu); bignáni (mc); lencom-ô, linqué (md); becancha, becancla, congô, gongô (mj); butáua, butone (pp).	Leguminosae	0.655	EFGP
Alb_adi	Albizia adianthifolia (Schumach.) W.Wight	faróba-de-lala, farroba-de-lala	cobaga-ê, conecam, empantanca, unchámpô (bj); untchaintchain (cb); caroubier (fr); catchena (fs); marnei, nétèmàe, néto-máiô (fu); netô-farô (md); bianque (mj); masamp-thai (nl); alfarroba (pt); uasa-fiké (ss).	Leguminosae/ Mimosoideae	0.5956056	CARBOVEG
Alb_alt	Albizia altissima Hook.f.		nétéchango (fu).	Leguminosae/ Mimosoideae	0.52	Albizia spp. Brown97 / América
Alb_din	Albizia dinklagei (Harms) Harms	farroba-de-mato	nasce-fôrè (ba); correré (bj); bansabúle (bm); gaúde (ff); bubricaramba (fs); netechaguhol, sindjadjálê, sindjalale (fu); masamp, masamp-tchill, masang-na (nl); ussúmbulo (pp); safatá, uasafore, (ss).	Leguminosae/ Mimosoideae	0.52	Albizia spp. Brown97 / Africa
Alb_fer	Albizia ferruginea (Guill. & Perr.) Benth.	faróba-de-lala, farroba-de-lala	untchampo (bj); furbirõ (cs); marnei, nete-maio (fu); farranetó (md).	Leguminosae/ Mimosoideae	0.47	Brown97 / Africa
Alb_gla	Albizia glaberrima (Schumac		uarmáma (fu); tangalamara (md).	Leguminosae/ Mimosoideae	0.52	Albizia spp. Brown97 / Africa

	h. & Thonn.) Benth. var. glaberrima					
Alb_rho	Albizia rhombifolia Benth.		djêgo, nétè-cula (fu); d'jagu (md); quéquê-camacama (ss).	Leguminosae/ Mimosoideae	0.52	Albizia spp. Brown97 / Africa
Alb_zyg	Albizia zygia (DC.) J.F.Macbr.	pó-de-raio	biaioga, buiaioga (bf); cobaga-ê (bj); bunike (fs); mabodadi, marroné, tali, taliba, uarmáua (fu); tangalamára (md); masamp, msamp-m'boko (nl); tombonka're (ss).	Leguminosae/ Mimosoideae	0.46	Brown97 / Africa
Alc_cor	Alchornea cordifolia				0.731101955	Dens. Média CARBOVEG
All_afr	Allophylus africanus				0.45	Brown97 / Africa
Als_boo	Alstonia boonei De Wild.	tacára, tagara, tagarra	biangue, bianque, psoque,(ba); polõfuru (cs); banta-forodjé, bantera-fôrô, batanforo (fu); batacar (mc); iangué, ianké, ianque (nl)	Apocynaceae	0.33	A. congensis Brown97 / Africa
Als_con	Alstonia congensis Engl.	tacára, tagara, tagarra	djambé (ba); cudjésse, quessum (bj); léguerè (ff); bantam-foro (fu); betácarre (mc); bantam-forô (md); bidjésse (mj); batáguar (pp); iangué, ianké, ianque (nl).	Apocynaceae	0.33	Brown97 / Africa
Ana_occ	Anacardium occidentale L.	Cadju	Ncadju (mj)	Anacardiaceae	0.431	GlobalWoodDensityDatabase
Ani_lau	Anisophyllea laurina R.Br. ex Sabine	miséria, pau-miséria, pó-de-miséria	mafel, máfèlè (ba); budjagálá (planta), mandjagálá (fruto) (bf); edoconhe (bj); kanse (fu); n'sunp, sénhè, unsununtu (nl); cantingui (ss);	Rhizophoraceae	0.7308752	CARBOVEG

			angueidja (td).			
Ant_dja	Anthocleista djalonensis A.Chev.		tagare (fu); bintié (mj).	Loganiaceae	0.5	A. keniensis Brown97 / Africa
Ant_mac	Anthonotha marcophila				0.78	Brown97 / Africa
Ant_mem	Antidesma membranaceum				0.731101955	Dens. Média CARBOVEG
Ant_pro	Anthocleista procera Lepr. ex Bureau	caboupa-matcho	kufá, cúfè (ba); (ba); cadjangue, cadjanuè (bj); beidomodjô, tagare (fu); bintié (mj); papae-um-eme (pp); dissauri (ss).	Loganiaceae	0.5	A. keniensis Brown97 / Africa
Ant_sen	Anthostema senegalense A.Juss.	binhal, pó-de-binhal, pó-de-lete	p'tone (ba); cabate, cabete (bj); bulucune (fs); bufena, m´burô, umburo (fu); mante (nl); minhále, tagi (pp).	Euphorbiaceae	0.5546252	CARBOVEG
Ant_tox	Antiaris toxicaria subsp. welwitschii var. africana (Engl.) A. Chev.	língua-di-baca, pau-bicho, pau-de-bicho-amarelo, pó-de-bicho-branco, po-de-bitche, pó-de-lete	noii (bj); djauláe, nhenhe, tambatchilam, tchime (fu); tumbuiru (md); binam-ne, cóngoró, cóngôrô, (mj); bucanhe (pp); n'nhonhinhe (ss).	Moraceae	0.37	Brown97 / Africa
Ant_ven	Antidesma venosum E.Mey. ex Tul.			Euphorbiaceae	0.731101955	Dens. Média CARBOVEG
Ant_vog	Anthocleista vogelii Planch.	acuapôpo, caboupa-matcho	cadjanué (bj); ugumba, undango (cb).	Loganiaceae	0.5	A. keniensis Brown97 / Africa
Aph_sen	Aphania senegalensis (A.Juss. ex Poir.) Radlk.	cerença, cerija, serinça	m'bôtcherê (ba); buiema (dj); bulebo (fl); culneldacu, mantchampôdje (fu); simbode-ô, simbondô (md); bute, n'pórlô, obalei (pp).	Sapindaceae	0.731101955	Dens. Média CARBOVEG
Arv_desc	Árvore				0.731101	Dens. Média

	viva desconhecida				955	CARBOVEG
Arv_mort	Arvore morta em pé				0.328	Dens. Mínima das árvores vivas CARBOVEG
Avi_ger	Avicennia germinans (L.) L.	tarafe, tarrafé, tarrafe	béthá, ió, petá, péthsá (ba); bufendê (planta), m'pendê (população de plantas) (bf); cobaca, cudjuno (bj); behelm, ùle (cb); cabêço, camangacú (fl); úle (mc); djibicum, tarafô, (md); pebadje, púle (mj); iófo, n'kim (nl); búle (pp); uofiri (ss).	Avicenniaceae	0.756	CARBOVEG
Bli_sap	Blighia sapida K.D.Koenig		m'butchiri (ba); otau (bj); cuiema (dj); féso (fu).	Sapindaceae	0.74	B. welwitschii Brown97 Africa
Bli_uni	Blighia unijugata Baker	osso-de-dari	bissabe (bf); democôri, sátágá-preto (fu); firifora (md); m'but-balé, n'timlake (nl); beleque-súlè (ss).	Sapindaceae	0.74	B. welwitschii Brown97 Africa
Boi_mam		Boila mamba			0.731101955	Dens. Média CARBOVEG
Bom_cos	Bombax costatum Pellegr. & Vuillet	Polóm-fidalgo, polóm-fôro, sumauma	bumbum, buúforè (ba); brêgue (bf);; djóia, djóè (ff); djóia, djóè, luncum (fu); belofa (mc); buncum-ô (md); djóia, belofa (mj); ulófo (pp).	Bombacaceae	0.4931059	CARBOVEG
Bor_aet	Borassus aethiopum Mart.	cibe	bace (ba); buár (bf); eudá (bj); dúbè, palmier-rônier, rônier (fc); dúbè (ff); cibedje (fu); cibô (md); n'bene, umbena (mj); buane, opane (pp).	Palmae	0.885	EFGP
Bri_mic	Bridelia micrantha (Hochst.) Baill.	bissáca	tagate (ba); bissai, bussácá (bf); endure, n' tongue, untágué, untongue	Euphorbiaceae	0.47	Brown97 / Africa

			(bj); utchak (cb); fudetchir (fs); bissoia, gúgri (fu); bissaiô, bissoia (md); m'bonhé, n'taque (nl); bissaque (pp); tolingué, tolingi (ss).			
Byr_bro	Byrsanthus brownii Guill.			Euphorbiaceae	0.731101955	Dens. Média CARBOVEG
Car_pro	Carapa procera DC.	cola-amargoso, cola-malegossa	caranhane (bj); punhe (bm); kola-malgos, pada-di-kola, siti-malgos (cs); bunhogone (dj); boculamape (fl); boncom-hadje, gobi, mambodadje (fu); maló, boncom-ô (md); bépale, buaque, cóque (mj); bóco (pp).	Meliaceae	0.59	Brown97 / Africa
Cas_sie	Cassia sieberiana DC.	canafistra, canafístula, sambassinhague	p'fonante (ba); bissindje, bussindja (bf); caquecequece (bj); sama-sidjam, samba-sindjandje samba-sinhangho, sambasinhanha, sambassinhamé, sandjoné, sanjoué (fu); sindjam-ô (md); bentape, n'tame, untame (mj); betame (pp).	Leguminosa/Caesalp.	0.72	Nygard & Elfving 2000
Cei_pen	Ceiba pentandra (L.) Gaertn.	Poilão, poilon, polóm	psáhè, pthaé, rumbum (ba), brêgue (bf); cob-bê, fromager (bj); bantanhe (ff, fu); pentene (mc); bantam-ó (md); péntia (mj); m'bath (nl); metchene, n´tene, untene (pp).	Bombacaceae	0.26	Brown97 / Africa
Cit_sin	Citrus sinensis	Larandja	Plele (mj)		0.731101955	Dens. Média CARBOVEG
Col_cor	Cola cordifolia (Cav.) R.Br.	mandjanja, manjandja	m'bué (ba); budjanhi (bf); utuludjene (dj); tábá (fu); tabô (md).	Sterculiaceae	0.458	EFGP
Col_nit	Cola				0.7	Cola sp. /

	nitida					Brown97 / Africa
Com_ade	Combretum adenogonium Steud. ex A.Rich.	Jambacatá	djambacatã (bf); djambacatam-ô (ff); bané, djambacatam (fu); djambacatam-quéo (md).	Combretaceae	0.731101955	Dens. Média CARBOVEG
Com_c_g	Combretum collinum subsp. geitonophyllum (Diels) Okafor		bierrequêtê (bf); djambacatá (fêmea) (fu); hiremoussôlo, madifô, (md).	Combretaceae	0.731101955	Dens. Média CARBOVEG
Com_c_h	Combretum collinum subsp. hypopilinum (Diels) Okafor			Combretaceae	0.731101955	Dens. Média CARBOVEG
Com_mic	Combretum micranthum			Combretaceae	0.736	Nygard & Elfving 2000
Com_nig	Combretum nigricans var. elliotii (Engl. & Diels) Aubrév.	pau-de-pilão	betne (ba); betne, bunro (bf); buidé, dodje-górè, úidè (fu); djambacatam-ô (md); atchelogon, tchelogom (td).	Combretaceae	0.957348	CARBOVEG
Com_sp	Combretum sp				0.731101955	Dens. Média CARBOVEG
Cor_pin	Cordyla pinnata (Lepr. ex A.Rich.) Milne-Redh.		psila (ba); dirqué, dóki, duco, dúki, dúquei, (fu); doto, dúnta, dutos, ulacomô-dutô (md).	Leguminosae/ Mimosoideae	0.719	EFGP
Cra_lau	Craterispermum laurinum				0.731101955	Dens. Média CARBOVEG
Cro_feb	Crossopteryx febrifuga (Afzel. ex G.Don) Benth.		baradagamarama (bf); belim, colidjâncuma, (fu).	Rubiaceae	0.731101955	Dens. Média CARBOVEG
Dal_boe	Dalbergia boehmii Taub.		bierequété (bf); godjoli (fu); n'pessa, umpessa	Leguminosae/ Mimosoi	0.731101955	Dens. Média CARBOVEG

			(mj); n'ticambague (nl); simoili (ss); ambrecome (td).	deae		
Dan_oli	Daniellia oliveri (Rolfe) Hutch. & Dalziel	pau-incenso, pó-de-incenso	bóbe (ba); ucumbo (bj); si-bink (cs); santan, tchébè, tchéne (fr); tchénè (fu); santam-ô, santam-um, santangô (md); becúncaro, biécar (mj); boto, m'bétá (nl); rúngulo, untande (pp); kaméuri (ss).	Leguminosae	0.536	EFGP
Dat_mic	Detarium microcarpum Guill. & Perr.	mamboli	códóde (bj); bôto, compondôgô, pompôdôgô (fu); sárôco, sara-ôncô (md); m'betá, m'petch (nl); amule (td).	Leguminosae	0.565	Nygard & Elfving 2000
Dat_sen	Detarium senegalense J.F.Gmel.	mambode	bobode (bf); cudoce (bj); boto, pó-pondogo, querenduta (fu); mabodô, sarôco (md); bumbuar (mj); bórrè (pp).	Leguminosae	0.547	EFGP
Det_sp	Detarium sp				0.731101955	Dens. Média CARBOVEG
Dia_gui	Dialium guineense Willd.	beludo, pau-veludo, pó-de-veludo, veludo	m'boié, n´boi, umboi (ba); bufarô (bf); epádum (bj); uparan (fs); boiè-maio, cossiráe, mèco, moquê (fu); citó, cossitô, moquê (md); bebúi, bubúi (mj); m'bim, m'bimbe (nl); moquê (ss); atenguengelere (td).	Leguminosae	0.698	EFGP
Dic_cin	Dichrostachys cinerea subsp. platycarpa (Welw. ex W.Bull) Brenan & Brummitt var.	fedida-branco, ferida-preto; fididi-preta, pau-ferida, pó-de-fidida-preto	biohé-mone, duê (ba); emudu (bj); sipiñan (cs); bulabêlê, bula-bétè, bulé, bule-baledje, bulu-caledje, búrlè, burlei, búrlè-lubode, burlé-lubodje, búrli (fu); n'gami-coió, n'gari-coió (md).	Leguminosae/ Mimosoideae	0.9196014	CARBOVEG

	platycarp a					
Dio_ell	Diospyros elliotii (Hiern) F.White			Ebenac eae	1.03	Diospyrus sp. Reyes et al. 1992
Dio_fer	Diospyros ferrea (Willd.) Bakh.			Ebenac eae	1.03	Diospyrus sp. Reyes et al. 1992
Dio_heu	Diospyros heudelotii Hiern		ebangleba (bj); silabono (fu); cussito, malefu (md); jagôrtá, n'jangugurta, tchamburtá (nl); iatété, malefú, malevu (ss); culum (td).	Ebenac eae	0.938400 3	CARBOVEG
Eke_cap	Ekebergia capensis				0.731101 955	Dens. Média CARBOVEG
Ela_gui	Elaeis guineensi s Jacq.	palmera	quem, ribe (ba); benintchi, bunintchi (bf); eárra, lara (bj); palmier-à-huile (fc); tuguêih (ff); tem-em-eih (fu); tem-ô (md); mintchame (mj); n'quemê (pp); palmeira de azeite, palmeira de óleo, palmeira déndém (pt).	Palmae		
Ery_afr	Erythrophl eum africanum (Welw. ex Benth.) Harms		corombel, gerombéle, pele, péli, querenduta (fu); cursonsum-ô, cussonsom (md).	Legumin osae	1.02	Média de E. africanum em Brown97
Ery_sen	Erythrina senegale nsis DC.	bissaca, pó-de-osso, pó-di-osso, pó-di-conta	m'zisse (ba); burale, sélélé (bf); cusserê (bj); pó-di-budogo (cs); arbre-corail, erythrine du Sénégal (fr); bondja, botchotchadje, bothola, mochôla, m'zisse (fu); dlim-ôdolim-ô (md); n'chaka-refat, n'tchakarfat (nl); bissansce (pp).	Legumin osae/ Mimosoi deae	0.31	Média de Erythrina sp. em Brown97
Ery_sig	Erythrina		dolim-bá, dolimba	Legumin	0.31	Média de

	sigmoidea Hua		(md).	osae/ Mimosoideae		Erythrina sp. em Brown97
Ery_sua	Erythrophleum suaveolens (Guill. & Perr.) Brenan	mancone, manconi	betomo, otone (ba); budatchai (fs); talidje, téli (fu); mãnçone (cs); buirame (fl); betitche (mc); tálô (md); baier (=amarga), bentabe (mj); betitche (pp).	Leguminosae	0.824	EFGP
EspDesc	Espécie viva desconhecida				0.731101955	Dens. Média CARBOVEG
Euc_lon	Euclinia longiflora				0.731101955	Dens. Média CARBOVEG
Fai_alb	Faidherbia albida (Delile) A. Chev.	ferida-branco, pau-ferida, pó-de-ferida-branco	bioépi, djúè (ba); camude, camudé, camudo (bj); biongômo (bm); sipiñã, sipiña-brabu (cs); busseu-uliba (fl); cad (fr); bubirique (fs); borassanhe, buladanêlhe, bulé, búrlè-danédjo, marroné, (fu); betampale (mc); borassam, borassam-ô (md); butchampele (mj)	Leguminosae/ Mimosoideae	0.731101955	Dens. Média CARBOVEG
Fic_dic	Ficus dicranostyla Mildbr.		sur (ba); d'jambô, djambo-surei suredje, surei (fu); anak (td).	Moraceae	0.465	Média de Ficus sp. em Brown97
Fic_exa	Ficus exasperata Vahl	acarta-lixo, língua-di-baca, po-di-lixa,(cr)	noii (bj); uiássiáss (cb); karda (cs); nhinha (fu); bungadjé, n'cungre (uncungre) (mj); cuncre, cungre, n'cuncre, uncuncre (pp).	Moraceae	0.465	Média de Ficus sp. em Brown97
Fic_glu	Ficus glumosa Delile	pau-de-leite	ságuê (ba); quequeiè (fu); sótô (md).	Moraceae	0.465	Média de Ficus sp. em Brown97
Fic_ova	Ficus ovata			Moraceae	0.465	Média de Ficus sp. em Brown97
Fic_sp	Ficus sp				0.465	Média de Ficus sp. em

						Brown98
Fic_sur	Ficus sur Forssk.		blata, tumbli (ba); canhamá, catchocodo (bj); défay (cs); bucune (fs); tcheque, tchequedje (fu); buncuncul (mc); turô (md); cuncre, cungre, n´cungre, uncungre (mj); tonkin-iá, tonquinha (nl); uncúngne (pp); anaque (td).	Moraceae	0.465	Média de Ficus sp. em Brown97
Fic_syc	Ficus sycomorus subsp. gnaphalocarpa (Miq.) C.C.Berg		chéque, tcheque (pl. tchequedje) (fu); cungre, n'cungre, uncungre (mj).	Moraceae	0.465	Média de Ficus sp. em Brown97
Fun_afr	Funtumia africana (Benth.) Stapf		ripetche (ba); budiquédo (fu).	Apocynaceae	0.4	Reyes et al. 1992
Gar_imp	Gardenia imperialis K.Schum.		tári-sútò (fu).	Rubiaceae	0.76	Gardenia sp. em Brown 97
Gar_ter_S	Gardenia ternifolia subsp. jovis-tonantis var. goetzei (Stapf & Hutch.) Verdc.		brintintchi (ba); undágál (cb); bosseléole, djugale (fu); bireu (mc); n'dô (nl).	Rubiaceae	0.655	Nygard & Elfving 2000
Gar_ter_W	Gardenia ternifolia subsp. jovis-tonantis (Welw.) Verdc. var. jovis-tonantis		djugale (fu); n'dué (nl).	Rubiaceae	0.655	Nygard & Elfving 2000
Han_und	Hannoa undulata (Guill. & Perr.) Planch.		psône, psunn, tibdé (ba); tchuco (bj); colanzu, colonzo, quécui, quécui-djom, tibedé (fu); bren (mc); kéo-fôro (md).	Simaroubaceae	0.731101955	Dens. Média CARBOVEG

Har_mad	Harungana madagascariensis Lam.	canho, pó-di-faia	mintchéle, umpátè (ba); canho, uómnhé (bj); utéhia (cb); súngala (ff); chungalá, sungala (fu); sumbalá, uliéli, ulielò (md); binhanhaque (mj); acanjongra (td).	Euphorbiaceae	0.45	Reyes et al. 1992
Hei_par	Heisteria parvifolia				0.731101955	Dens. Média CARBOVEG
Hex_cri	Hexalobus crispiflorus A.Rich.			Annonaceae	0.48	Reyes et al. 1992
Hex_mon	Hexalobus monopetalus (A.Rich.) Engl. & Diels	mambumba	bacuré, boile, boili, canjé, tapircó (fu)	Annonaceae	0.827473	CARBOVEG
Hol_flo	Holarrhena floribunda (G.Don) T. Durand & Schinz	bribait, bripatche	rubitchi (ba); ete-éri (bj); machalô (fs); charra-quidjé, endama, rubitchi, tcharaquidje, tchoráqui (fu); bedufe, bedufi, bidufe (mc); tcharico (md); metchel (nl); kamaitê (ss).	Apocynaceae	0.731101955	Dens. Média CARBOVEG
Hun_umb	Hunteria umbellata (K.Schum.) Hallier f.	pó-di-pinti	báuri (fu); belace, belaha (mj); n'tchintchamp (nl); balé (ss).	Apocynaceae	0.926	CARBOVEG
Hym_aci	Hymenocardia acida Tul. var. acida	Coroncond e, coronconto	beninebahan, betenam (ba); coroncondô (bf); corocondé, oábi (bj); pilitoró (ff); bodi, caraconde, corocondé (fu); corocondô, cureucóndô (md); matikzé, n'tisé (nl); curencúnde, simóilé, simóieli (ss).	Euphorbiaceae	0.702	GlobalWoodDensityDatabase
Hym_heu	Hymenocardia heudelotii Planch.			Euphorbiaceae	0.731101955	Dens. Média CARBOVEG

	ex Müll.Arg.					
Hym_lyr	Hymenocardia lyrata Tul.		odinaco (bj).	Euphorbiaceae	0.731101955	Dens. Média CARBOVEG
Kee_sp	Keetia sp				0.731101955	Dens. Média CARBOVEG
Kha_sen	Khaya senegalensis (Desr.) A.Juss.	bissilão, bissilon	famé, iacume, tagmi, táminii (ba); bussilô (bf); unchómrô, unchonro (bj); betenhète (dj); cáe (ff); acajou-du-Sénégal, caïcédrat (fr); cáe (fu); biaiérre (mc); djaló (md); béntia, bentiene, betone (mj); embale, utime (pp).	Meliaceae	0.608	EFGP
Lad_heu	Landolphia heudeloii				0.731101955	Dens. Média CARBOVEG
Lag_rac	Laguncularia racemosa				0.731101955	Dens. Média CARBOVEG
Lan_aci	Lannea acida A.Rich.	mantede	dôto (ba); ututene (fs); bembedja, bembem-hei, tchingole (fu); bémbô (md); betôlôdje (pp).	Anacard.	0.465	Nygard & Elfving 2000
Lan_nig	Lannea nigritana (Scott-Elliot) Keay	mantede	bembedje, bembem-hei, tchingole (fu); bêmbô (md); betôlôdje (pp)	Anacard.	0.611	L. velutina CARBOVEG
Lan_sp	Lanea sp				0.731101955	Dens. Média CARBOVEG
Lan_vel	Lannea velutina A.Rich.	bembei, dembei, mantede	dôtô (ba); bembedje, bembei, bembem-hei, tchingole (fu); bémbô (md); betôlôdje (pp)	Anacard.	0.611	CARBOVEG
Lec_cup	Lecaniodiscus cupanioides Planch. ex Benth.		sátaga (fu)	Sapindaceae	0.8556739	CARBOVEG
Lop_lan	Lophira lanceolata	mené	p'fancha (ba); udoma (bj);	Ochnaceae	0.706	EFGP

	Tiegh. ex Keay		malanga, marnenáe, p'bancar (ff); ledalbodeel, malanga, marnenáe, p'bancar (fu); mufó (pp); mené (ss).			
Mal_aln	Malacantha alnifolia (Baker) Pierre		ukíssig (cb); lixa (cr); cafore (dj); nhada-haco, nhénhéò (fu); mafaléu (nl); lakó, lalaúri (ss).	Sapotaceae	0.6999394	CARBOVEG
Man_ind	Mangifera indica	mango	pamango (mj); manga, mangueira (pt)	Anacardiaceae	0.552	GlobalWoodDensityDatabase
Mar_tom	Markhamia tomentosa (Benth.) K.Schum. ex Engl.		boloitche (ba); n'álè (um-hálè) (fu).	Bignoniaceae	0.473	GlobalWoodDensityDatabase
Mil_reg	Milicia regia				0.439	EFGP
Mor_gem	Morinda geminata DC.	boloncodjibá-macho, bolongodjiba, bulungu-djubá	gunhe, n'dunquinhe, n'gume, ungume (ba); bulongodjibá (bf); obonodje (bj); bubalden (dj); n´garba, ungarba (ff); biloncontchebáe, bolonco-tchibá, dacuré, lhiamba, n'garba, uanda, wáda (fu); biloncondjebá, boloncom, boloncondjibá , goloneogita, simbom-ô, u	Rubiaceae	0.731101955	Dens. Média CARBOVEG
Mor_luc	Morinda lucida Benth.			Rubiaceae	0.731101955	Dens. Média CARBOVEG
Mor_sen	Morelia senegalensis A.Rich.			Rubiaceae	0.731101955	Dens. Média CARBOVEG
Neo_mac	Neocarya macrophylla (Sabine)	Mampatace-grande, tamankumba,	n'bute (umbatú), n'djapô, téhè (ba); bufângha (bf); nórònóròdó,	Chirysobalanaceae	0.731101955	Dens. Média CARBOVEG

	Prance ex F.White	tambacumb a	nororodo, orodjô (bj); cura-bussuma (ff); bio, quió (fruto) (fl); batè (fs); curanaco, nando, náudo (fu); menau, bénôbénô, bitiague (mc); tambacumba (md); bénôbénô, bitiague, menau (mj); mavé			
New_lae	Newbould ia laevis (P.Beauv.) Seem.	Manduco-de-feticero	bugampal (bf); canhom, cassinconco (bj); mãnduk-difuti-siru (cs); sucúndè (ff); fugumpa (fs); canhómburi (fu); becuape (mj); n´simkété, singèle (nl); angade-tcharre (td).	Bignoni aceae	0.731101 955	Dens. Média CARBOVEG
Oxy_aby	Oxytenant hera abyssinic a				0.731101 955	Dens. Média CARBOVEG
Par_big	Parkia biglobosa (Jacq.) R.Br. ex G.Don	faroba, farôba, farroba, farrobe	gante, mehanté (ba); biáie, buiái (bf); canhando (o fruto), em-bando, nándo, n'andu, unhando (árvore) (bj); poroba (cs); caroubier-africain, mimosa-poupre (fr); néré, netch, nétè (fu); olélè, ulélè (mc); nétè (md); ií (nl); olélè, ulélè (pp); néri (ss); a	Legumin osae/ Mimosoi deae	0.533	EFGP
Par_exc	Parinari excelsa Sabine		meile, n'djano, pilé, undiano (ba); bussol, mantchoul (fruto) (bf); kankenom (fruto), nhêg-cuneme, uguene, ukenom (bj); mampatace, mampatás, mampataz (cr); cura (ff); bionai (fs); cura, curanaco (fu); minquela (mc); mampatá (md);	Chiryso balanac eae	0.604	EFGP

			bitchalam, n'tchalame (mj			
Per_lax	Pericopsis laxiflora (Benth. ex Baker) Meeuwen		cúlèculè, culi-culi; culu-cula (fu); baba, buba (mj).	Leguminosae/ Mimosoideae	0.94	Pericopsis sp. em Brown 97
Pho_rec	Phoenix reclinata Jacq.		sarábá, sérquê (ba); buadiá (bf); mandjaca (bj); bêlem (fu); bam-ò, corossedjambo, córóssó (md); bedjaca, m'jacai (mj); medjaca (pp).	Palmae		
Pil_ret	Piliostigma reticulatum (DC.) Hochst.		pouúnquè (ba); canná, epamámbo (bj); bárquè (fu); fará (md); n'toncre, untoncre (pp).	Leguminosae	0.641	Nygard & Elfving 2000
Pil_tho	Piliostigma thonningii (Schumach. & Thonn.) Milne-Redh.	fará, panu-di-kankora	boã, mansonca, mansanca, pouúnquè (ba); fará, bufárá (bf); canna, epamámbo, epandando (bj); budandepe, bupande (fs); baiqué, bárquè, barquedje, barqueiê, bongué, fará (fu); fará (md); impukui, m'bukui mukui (nl); n'tangré, n'toncre, untoncre (pp).	Leguminosae	0.7652155	CARBOVEG
Pre_his	Premma hispida				0.86	Premna sp. em Brown 97
Pro_afr	Prosopis africana (Guill. & Perr.) Taub.	pau-carvão, pó-carvão, pó-de-carbom, po-di-carvom	tentera (ba); buiengué, bussagan (bf); karbon, késeg-késeg (cs); tchelem (ff); tchalem-ai, tchela, tchelangadje, tchelem (fu); bal-tencali, culengô, culim-ô, djandjam-ô, quéssem-quéssem (md); djeiha, ogea (pp).	Leguminosae/ Mimosoideae	0.847	EFGP
Pte_eri	Pterocarpus	pau-sangue, pó-	psilá, sila (ba); buana (bf); bane,	Leguminosae/	0.616	EFGP

	erinaceus Lam. ex Poir.	di-sangue	báni, djêgo (fu); beléle (mc); kenê, quénò (md); beléle, beliadje, betéi,olei (mj); n'sila (nl); beliadje, betéi, ulei (pp).	Mimosoideae		
Pte_san	Pterocarpus santalinoides L'Hér. ex DC.	mangantem	dêssa, dessáha, déxa (ba); antante, benganta (bf); ebontonton (bj); djégo (ff); djecudjecumádje, d'jega, d'jego, mangantum,(fu); nitichiba, n'tisebá, sibá (nl).	Leguminosae/ Mimosoideae	0.44	Pterocarpus sp. em Brown 97
Pyc_ang	Pycnanthus angolensis				0.409	Dens. Média GlobalWoodDensityDatabase
Rap_pal	Raphia palma-pinus (Gaertn.) Hutch.	tara, tarra	darré (ba); ápél (singular), befén (plural) (cb); mãmbãmpa-tara (cs).	Palmae		
Rhi_har	Rhizophora harrisonii Leechm.			Rhizophoraceae	1	R. mangle em Brown 97
Rhi_man	Rhizophora mangle L.	tarafe, tarrafe	senhea, sóle (ba); bufendê (planta), m'pendê (população de plantas) (bf); sem-ah (bm); irangá, ubá (bj); fussossá (dj); cassolaco (fl); palétuvier-rouge (fr); mancô (md); pidjeu (mj); bugáha,ugáha (pp).	Rhizophoraceae	1	Brown 97
Rhi_rac	Rhizophora racemosa G.Mey.	tarafe, tarrafe	cóbácá, codega, iranga, uba (bj);	Rhizophoraceae	1	R. mangle em Brown 97
Ric_heu	Ricinodendron heudelotii (Baill.) Pierre ex Heckel subsp. heudelotii		bidjabarrana (bf); n' tonte (nl); tonta (ss).	Euphorbiaceae	0.3649797	CARBOVEG

San_sen	Sansevierais senegambica				0.731101955	Dens. Média CARBOVEG
Sar_lat	Sarcocephalus latifolius	tambacumba-di-santcho			0.731101955	Dens. Média CARBOVEG
Sch_arb	Schrebera arborea A.Chev.	pau-goiaba, po-de-goiaba	bugóiaba (planta), goiaba (fruto) (bf); maharra (bj); batirô (md).	Oleaceae	0.607	EFGP
Sor_jug	Sorindeia juglandifolia (A.Rich.) Planch. ex Oliv.		m'riuol (ba); aionque (bj); balêbári (fruto), undêbári (planta) (cb); coxolourô, cupote-cuxolourô (fs); sandji- bombro (fu); lagari (mj); n'taluass, n'tchalúas, untchalbinass (nl); n'tata, untata (pp); ambilire (td).	Anacard.	0.731101955	Dens. Média CARBOVEG
Spo_mom	Spondias mombin L.	mandiple	p'sale, sale, samé (ba); budjábual (bf); negae, ogáe, ugai (bj); báfôssé (fruto), upôssé (planta) (cb); mandipul (cs); bujendendem (fs); prunes-mombin (fr); tchálè (fu); n'pela, umpela (mc); nincom-ô (md); pilme (mj); n'pilo, umpilo (pp)	Anacard.	0.5588044	CARBOVEG
Ste_tra	Sterculia tragacantha Lindl.	nassino, pau-corda, pó-de-cabaço	búè, umbufúrè (ba); ereitô, éritú, freitô (bj); dácud, úcud (cb); barquelei, tabáe, tchapelêguê, tehapeleque (fu); bamé (mc); d´jubitabô, tabá, tabô (md); ibulbbecana, n'bama, umbana (mj); bamba (pp); mangéboré (ss); atakssulé (td).	Sterculiaceae	0.625	Média de Sterculia para África em Brown 97
Str_inn	Strychnos innocua Delile			Loganiaceae	0.731101955	Dens. Média CARBOVEG

Str_pus	Strombosia pustulata Oliv.	osso-de-dari	tinlake (nl).	Olacaceae	0.9079408	CARBOVEG
Syz_gui	Syzygium guineense (Willd.) DC. subsp. guineense	pó-branco	n'ocasso, nopêdê (bj); sotõno, trafidin-tera (cs); butote (dj); cadjô (ff); culelam-ô (md).	Myrtaceae	0.731101955	Dens. Média CARBOVEG
Ter_alb	Terminalia albida Scott-Elliot		cabuto (bj); furanfã (fs); sirafitom (md); n'tangunha (nl).	Combretaceae	0.9251145	CARBOVEG
Ter_avi	Terminalia avicennioides Guill. & Perr.		culume (fu); sirá-fitom, sirafitom (md).	Combretaceae	0.638	Nygard & Elfving 2000
Ter_lax	Terminalia laxiflora Engl. & Diels			Combretaceae	0.916	média de T. albida e T. macroptera CARBOVEG
Ter_mac	Terminalia macroptera Guill. & Perr.	karkone, macete, macite	fadi (ba); bulofôr (bf); djamba-catam (ff); bóde, bói (fu); bolóbô (mc); hólô-fôro (md); betáli, betcháli, betèlèdje, braqui, têlêjê (mj); n'kone (nl); n'túlam, untulam (pp).	Combretaceae	0.9065019	CARBOVEG
Tre_afr	Treculia africana Decne. ex Trécul subsp. africana var. africana		bala, busaka, sobsob (cs); guilinte (ff); guibinte, mantchampudje (fu); mantchambô (md); becuáe (mj); bulóio (pp).	Moraceae	0.731101955	Dens. Média CARBOVEG
Tre_ori	Trema orientalis (L.) Blume		buanhônhô (bf); nonha (bj); quere (fu).	Ulmaceae	0.3278344	CARBOVEG
Tri_eme	Trichilia emetica subsp. suberosa J.J.de Wilde	pó-cetona	búme, quécujon (fu); quécô (md)	Meliaceae	0.731101955	Dens. Média CARBOVEG
Tri_mon	Trichilia monadelpha		nequeno (bj).	Meliaceae	0.731101955	Dens. Média CARBOVEG

	(Thonn.) J.J. de Wilde					
Tri_pri	Trichilia prieuriana A.Juss. subsp. prieuriana		cudaco, nequeno (bj); fulubudjone (dj); cudaco (fl); djambadjilom, quibiricarre (fu); benkar (nl); bugondjôle (pp).	Meliaceae	0.63	Brown 1997
Unknown	Unknown				0.731101955	Dens. Média CARBOVEG
Vit_don	Vitex doniana Sweet	cetona, cetona-pequeno, cetona-preta	múni, múri (ba); bugúa (planta), mangúa (fruto) (bf); n'bumbo, ubumbo, ubunvo (bj); bujinke (dj); prunier-noir (fr); búmé (fu); cutóbulo, cutubulô (md); bessápale, munsopane (mj); gúa (pp).	Labiatae	0.4	Brown 1997
Vit_fer	Vitex ferruginea Schumach. & Thonn.			Labiatae	0.731101955	Dens. Média CARBOVEG
Vit_mad	Vitex madiensis Oliv. subsp. madiensis	azeitona, azeitona-pequeno, cetona, cetona-pequena	muni (ba); bugúa (planta), mangúa (fruto) (bf); bumé, bume-ainacobe (fu); intompinha, n'ssogorro (nl); kukukunkuri (ss); anhongore (td).	Labiatae	0.731101955	Dens. Média CARBOVEG
Voa_afr	Voacanga africana Stapf ex Scott-Elliot		blacahai (ba); epopoquê (bj); pau-de-borracha (cr); m'pumbu (nl).	Apocynaceae	0.731101955	Dens. Média CARBOVEG
Voa_tho	Voacanga thouarsii Roem. & Schult.			Apocynaceae	0.731101955	Dens. Média CARBOVEG
Xer_stu	Xeroderris stuhlmannii (Taub.) Mendonça & E.C.Sousa	pó-de-sangue-branco	bandanei, bani-dánè, bani-dani, bani-dárè (fu); n'bóbó (nl).	Leguminosae/ Mimosoideae	0.565	Nygard & Elfving 2000
Xim_ame	Ximenia	limon-do-	agara (bj); udôngul,	Olacace	0.646	Nygard &

	americana L.	mato, limon-di-sancho	undemna-aguidig (cb); citronier-de-mer, prunier-de-mer (fr); tcheme, tjeme (fu); tufissa (md); mampã (nl); tufissa, tumbecrinhaque (ss).	ae		Elfving 2000
Xyl_acu	Xylopia acutiflora (Dunal) A.Rich.		guilibete-bade (fu)	Annonaceae	0.731101955	Dens. Média CARBOVEG
Xyl_aet	Xylopia aethiopica (Dunal) A.Rich.	malagueta-da-guiné, malagueta-preta, malagueta-preto-de-guiné, malagueta-di-mato	sem-unte-pulhe, sentê (ba); eda, equêche, ocanhebo (bj); erauci (fs); guilé-balei, guilè-bétè (fu); idóié-iginal (mc); canafiô, janafim-ô (md); brôbleque, irú (mj); séla (nl); djodjô, djó-gófe, iobogôfo (pp); calantú, calatù (ss)	Annonaceae	0.5	Brown 1997 Africa
Zan_lep	Zanthoxylum leprieurii Guill. & Perr.		mádjá, mantcha, mantchu (ba); eranha (bj); barquelem (fu).	Rutaceae	0.731101955	Dens. Média CARBOVEG