MANOA REDD+ PROJECT

Prepared by:

Biofílica Investimentos Ambientais S.A

Project Title:	Manoa REDD+ Project
Version	v. 2.9
Date of issue:	November 28, 2017
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Project Title:	Manoa REDD+ Project
Project Location	Brazil, State of Rondônia, Cities of Cujubim, Itapoã do Oeste, and Porto Velho
Project Proponents	Biofílica Investimentos Ambientais (Project Main Proponent): Plinio Ribeiro, plinio@biofílica.com.br, +55 11 3073-0430 Triângulo Pisos e Paineis Ltda Douglas Granemann de Souza, triangulo@triangulo.com.br, +55 41 2106-5113
Auditor	Rainforest Alliance: Lawson Henderson, lhenderson@ra.org, +1 (202) 903-0717 IMAFLORA – Instituto de manejo e Certificação Florestal e Agrícola: Bruno Brazil de Souza, bruno@imaflora.org, +55 19 3429-0848
Project Start Date	January 01, 2013
Project Duration	30 years
GHGs Accounting Period	January 01, 2013 to December 31, 2042
Complete Validation or Gaps Validation	Complete Validation
History in CCB	Validation started on August 30, 2016
CCB Standards Edition	CCBA. 2013. Climate, Community, and Biodiversity Standards Third Edition. CCBA, Arlington, VA, USA. December 2013. At: www.climate-standards.org.
Short description of the expected benefits for the Climate, Community, and Biodiversity	Expected benefits for the Climate: A total of **8.378.697 tCO2eq emissions avoided** by the project, opposing a baseline scenario of 9.873.503,3 tCO2eq emissions due unplanned deforestation. The project leads to a scenario in which 22.118 hectares of deforestation is avoided along 30 years, as well as an average of 279.290 tCO2eq of reduced emissions. Expected benefits for the Community: With its own low-impact forest management infrastructure, the benefits to the local community and other stakeholders will be focused on training members of local associations and farm employees on issues such as agroforestry systems, low carbon agriculture, sustainable forest management, environmental eduction, and Associativism with a focus on young audiences in the region and small local producers. The actions will be carried out through quarterly activities (four times a year) involving a maximum of 30 people per course/qualification; Another benefit will be the support in the formation of skilled labor to act in the forest and non-timber forest management chain

	certified, seeking a regional scope for the target public. Expected benefits for Biodiversity: the maintenance of the project area forest coverage, along with the development of low impact forest management activities, ensure habitat protection in the Manoa Farm region, which has great diversity of species including threatened ones, according to IUCN (2014). There will be constant monitoring of high-value attributes, as the habitat hosts 177 of flora and more than 360 fauna species identified by a diagnostic conducted. Out of the fauna endangered species, 12 are of mammals and 9 of birds, registered in national and international threatened species lists, according to section 7.1.2 of this document; Manoa Farm is also part of a "green corridor", which connects several Conservation Units, reducing negative impacts of degradation in the region.
Compliance with Gold Level Criteria	**The project meets the criteria:** GL3. Exceptional Benefits for Biodiversity. Conservation high priority area: contains rare and endemic endangered species (according to IUCN), as the *Ateles chamek* (spider monkey) and *Pteronura brasiliensis* (nutria), both endangered.
DCP Date and Version	August 30, 2016, Version 1.0
Expected Verification Schedule	First Verification in the CCBS two years after the Validation, and subsequent verification every two years throughout the project life cycle. VCS verifications are expected every two years.

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1 GENERAL

1.1 Project brief description

Manoa REDD+ Project is a partnership between Biofílica and Grupo Triângulo, located at Manoa Farm, city of Cujubim, state of Rondônia, in an area of 74.038,7 hectares. Throughout its almost 30 years of history, Manoa has improved its management techniques, becoming a model of worldwide reference of forest exploration ally to with the conservation of nature.

The farm`s 73,000 hectares of forest demonstrates the pioneering in sustainable forest management, and are one of the few forest areas remaining in private area in the region, constantly threatened by invasions and timber theft. Manoa is of paramount importance in the landscape connectivity, as it is close to conservation units and provides shelter for several species.

Manoa Project will carry on the following actions to reduce deforestation and consequently reduce emissions:

- Forest protection and monitoring: remote monitoring and in local surveillance, along with the best sustainable forest management practices;
- Scientific research: monitoring of forest management impacts, follow-up and study of identified and/or endemic species, partnerships with educational and research institutions for the production and dissemination of knowledge;
- Local socioeconomic development: through its own training center, CEFLOM, the project provides trainings and capacitation in techniques aimed at encouraging sustainable development practices such as responsible forest management, agroforestry systems, low carbon agriculture, among others;
- Social empowerment: Strengthening and technical assistance for local producers' associations and environmental education interventions for the surrounding rural population and the municipality of Cujubim, aiming to strengthen small farmers, together with awareness of environmental issues, and consequent improvement in the quality of life of these people.

Climate Benefits

Avoid the emission of 279.290 tons of CO2e per year or 8.378.697 tons of CO2e along 30 years of project. This corresponds to 22.118 hectares of avoided deforestation.

Community Benefits:

The main objectives of the project for the community include the training of local stakeholders on issues related to sustainable economic development and the valorization of forest resources; Support to the development of associations of small local rural producers aiming at the social empowerment of these actors; And to members of neighboring associations of the project area and the young and university public of the state of Rondônia. These actions aim at improving the quality of life of this population, social empowerment, the strengthening of small farmers and the dissemination of practices of sustainable development in the region.

In the labor aspect of the property, it is expected the dissemination of knowledge about labor rights and rules to its employees and collaborators, environmental education workshops and the support in the training of skilled labor to operate in the supplychain of certified forest management and non-wood forest management.

Biodiversity Benefits:

Maintenance of forest coverage, preventing deforestation of approximately 12,000 hectares along 30 years of project. Conservation of 177 of flora and more than 360 fauna identified species. Out of these species, 12 are mammals and 9 are birds in some type of threat, according to IUCN. Maintenance of "ecological corridors" with Conservation Units of the state of Rondônia, reducing negative impacts of the region degradation.

1.2 Project location (G1 & G3)

Manoa REDD+ Project is located at Manoa Farm, which territory covers an area of 74,038,7 hectares in the cities of Cujubim, Itapoã do Oeste, and Porto Velho, state of Rondônia state (Figura 1), Northern Brazil. The vertices of Manoa Farm are found in Table 1

The access to the area is made through BR-364 highway, Porto Velho-Ariquemes, covering about 140 km up to RO-205 highway, which connects the city of Cujubim through 50 km of dirt road.

The project zone is defined as the "region that encompasses the project area, in which the activities that directly affect the land and associated resources, including activities related to provision of subsistence alternatives and community development, are implemented" (CCBA), comprising the area of Manoa Farm, totaling 74.038,7 hectares.

Table 1 Geographic coordinates of Manoa Farm vertices.

Vetex	X coordinate	Y coordinate
V 01	62°31'59,243"W	8°59'45,312"S
V 02	62°51'4,501"W	9°0'0,117"S
V 03	62°51'4,595"W	8°56'10,852"S
V 04	62°50'5,834"W	8°54'38,506"S
V 05	62°48'19,203"W	8°50'26,109"S
V 06	62°47'35,825"W	8°52'15,333"S
V 07	62°45'50,68"W	8°50'41,41"S
V 08	62°47'12,746"W	8°48'33,748"S
V 09	62°43'58,219"W	8°39'39,696"S
V 10	62°40'38,687"W	8°40'54,938"S

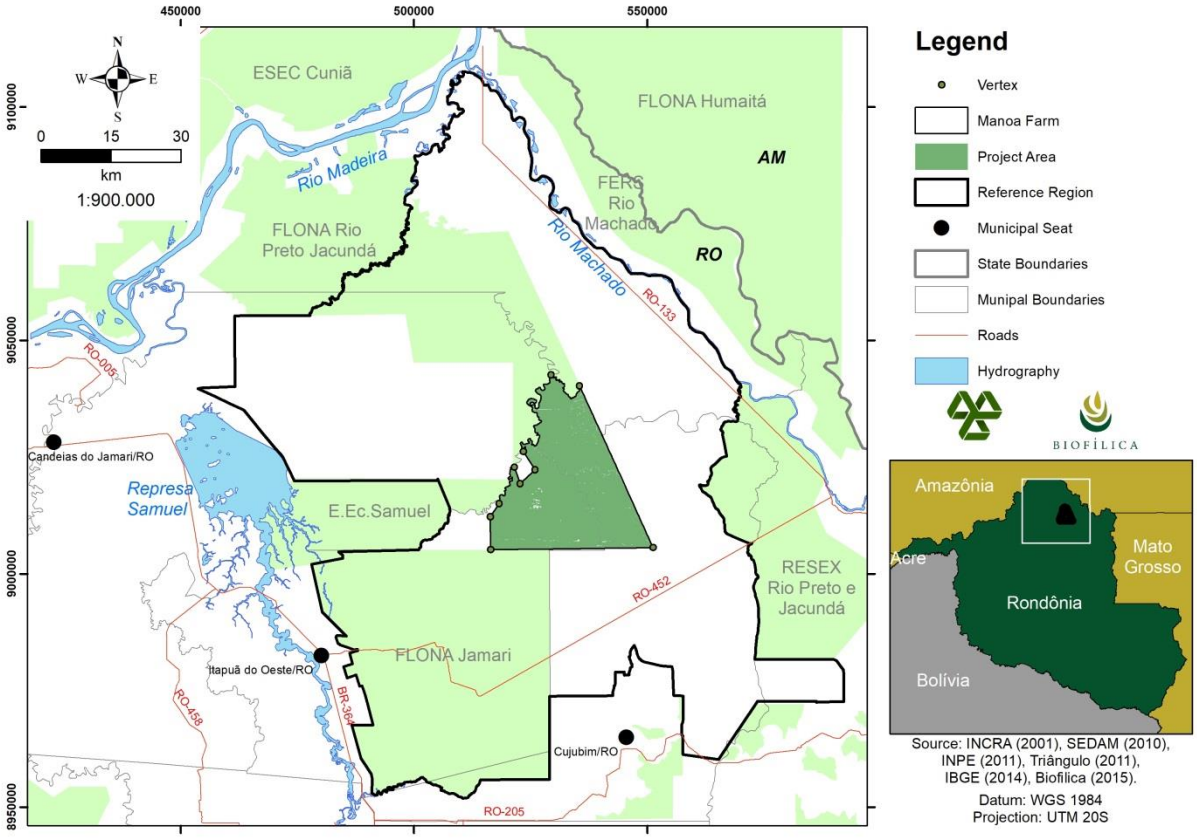


Figure 1 Location of the project limits

1.3 Project initial conditions (G1)

Manoa Farm has been sustainably managed since 1999, according to the Sustainable Forest Management Plan of the company. The management aims at timber production combined to the conservation of natural resources; therefore, it adopts low-impact harvesting techniques and meets all current legislation and forest certification principles. Thus, the project has not been implemented to generate greenhouse gases (GHG) emissions for the purpose of subsequent reduction, removal, or destruction. The following describes the conditions found prior to the Project start.

1.3.1 Biodiversity

Flora

The vegetation typologies found in the reference region are Open Ombrophilous Forest in the categories of lowland forests with palm trees, submontane forests with palm trees, and submontane with vines. Small spots of Ombrophilous Dense Forest under the uniform canopy submontane classification, as well as the forested savanna typologies, and emerging canopy alluvial forest can be observed. The Open Ombrophilous Forest tipology predominates in the project area, with formation of lowlands with palm trees, followed by Open Ombrophilous Forest, submontane with vines, and Open Ombrophilous Forest spots, submontane with palm trees (Casa da Floresta, 2015).

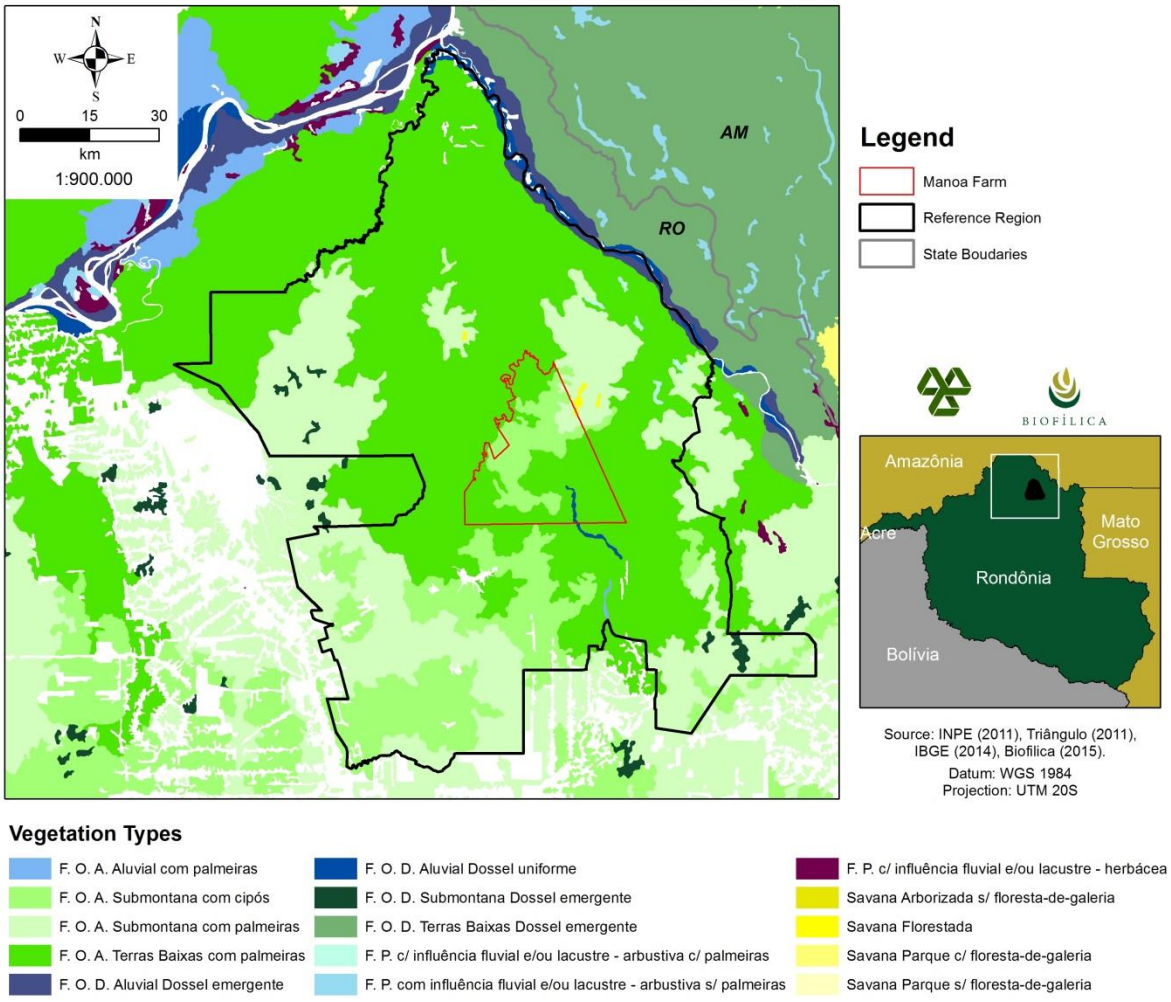


Figure 2 Classification of vegetation in the Reference Region of the Manoa Project.

Phytosociology

The phytosociological survey conducted in the project area showed a total of 177 arboreal species belonging to 45 botanical families. The family holding the largest species diversity is the Fabaceae with 50 species, followed by Arecaceae and Mavacea with 9 species each, Moracea, Sapotaceae and Lecythidaceae, with 8, 7 and 6 species, respectively.

Mammalian Fauna

The study conducted in the project area sampled 43 mid-size and large size mammal species, belonging to seven orders and 19 families. Carnivora and Primates are the most representative orders, with 12 and 11 species, respectively.

Avifauna

The project area registered 273 bird species, belonging to 22 orders and 53 families. This number, however, should significantly increase with greater sampling intensity. Literature points out a number of 472 bird species for the reference area.

Herpetofauna

Manoa Farm registered 44 species of herpetofauna, among which 30 are anuran amphibians and 14 are reptiles. The relatively low number of species may be associated to insufficient sampling effort, as well to the seasonality in which certain species are displayed.

Ichthyofauna

Literature data indicates the presence of 234 species of fish belonging to nine orders, and 38 families were registered for the reference area. The project area randomly registered 11 fishing fish species.

1.3.2 Physical parameters

Climate Aspects

According to Alvares et al. (2013) cited in Casa da Floresta Assessoria Ambiental Ltda. (2015), Rondônia state climate is classified as Am in the Köppen system, which means tropical monsoon climate, and the coldest month temperature is above or equal to 18°C, the driest month rainfall is below 60 mm and annual average total above 1,500 mm.

The Figure 4 shows temperatures and monthly average rainfall of the cities that compose Manoa REED+ Project Reference Region.

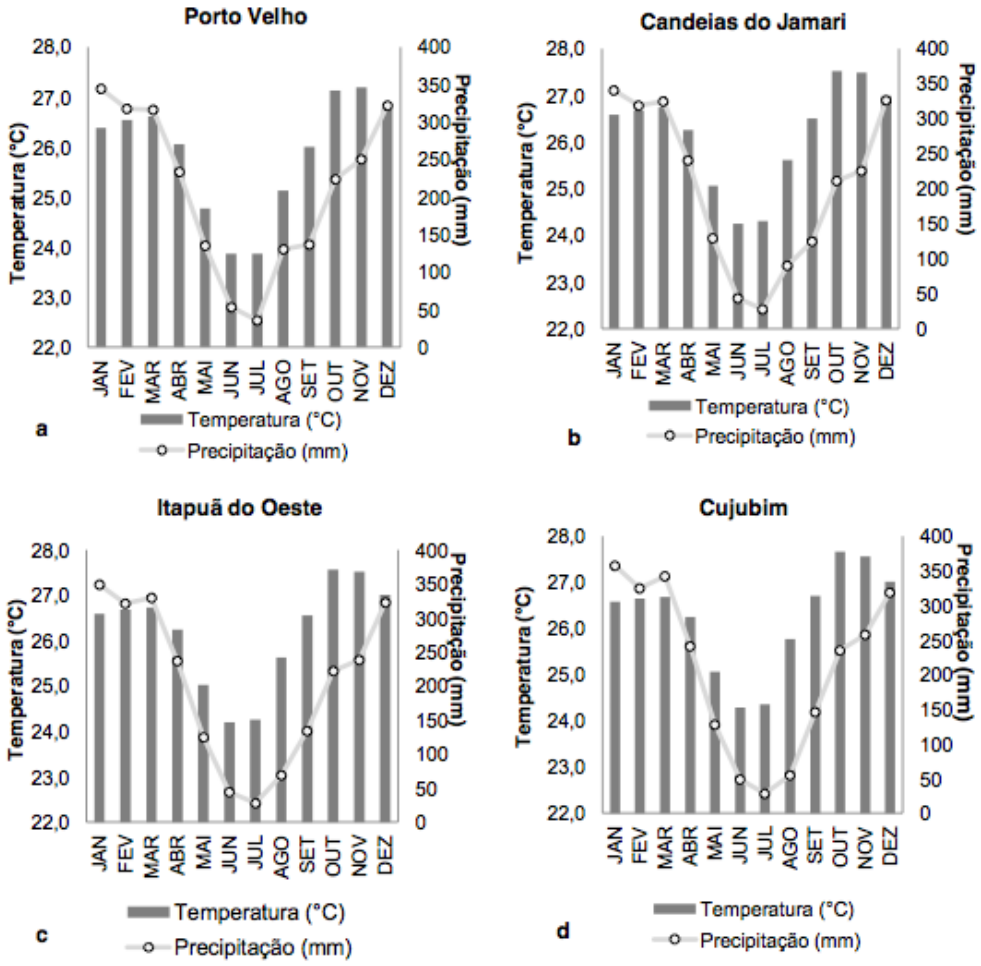


Figure 3 Climate charts of the cities that make up the reference region. a) Average monthly temperature and rainfall of Porto Velho; b) Monthly average temperature and rainfall of Candeias do Jamari; c) Monthly average temperature and rainfall of Itapuã do Oeste.

The Figure 4 and Figure 5 show the spatial distribution of annual average rainfall and annual average temperature, respectively, for the reference region.

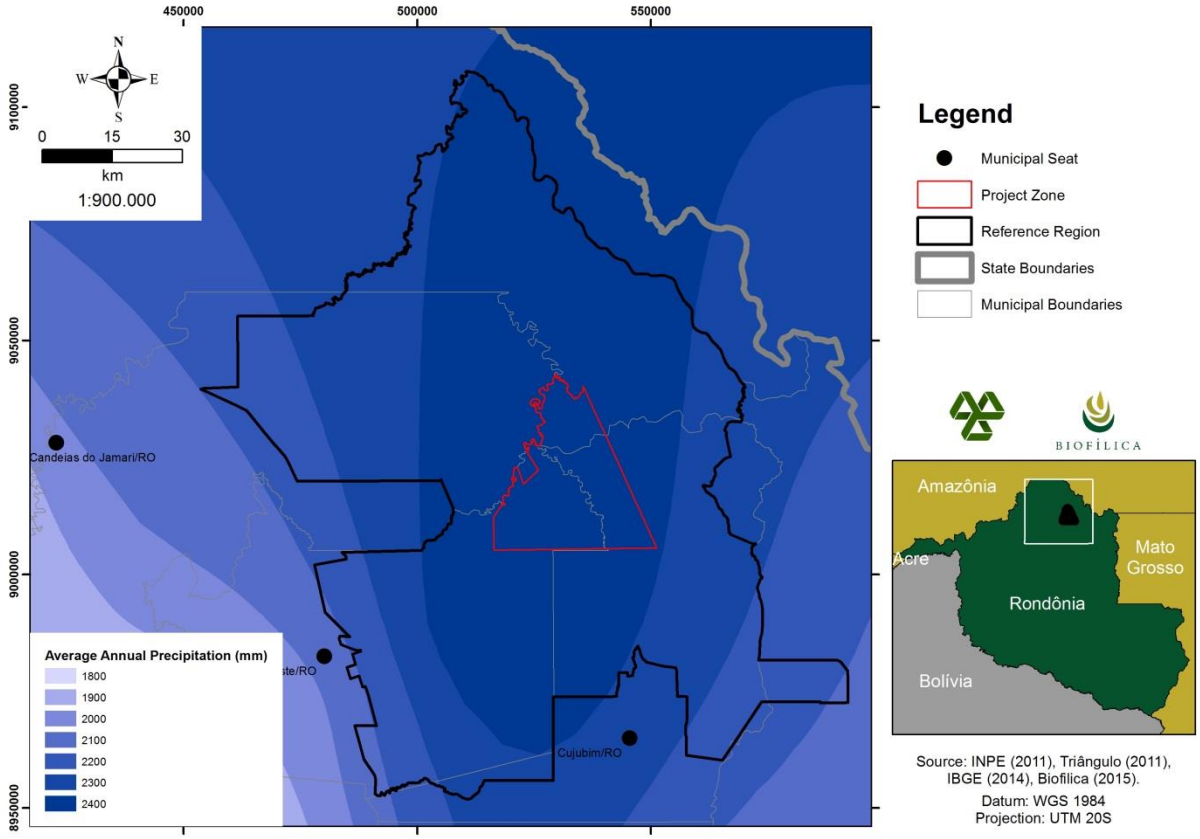


Figure 4 Average annual rainfall in the reference region of the Manoa Project.

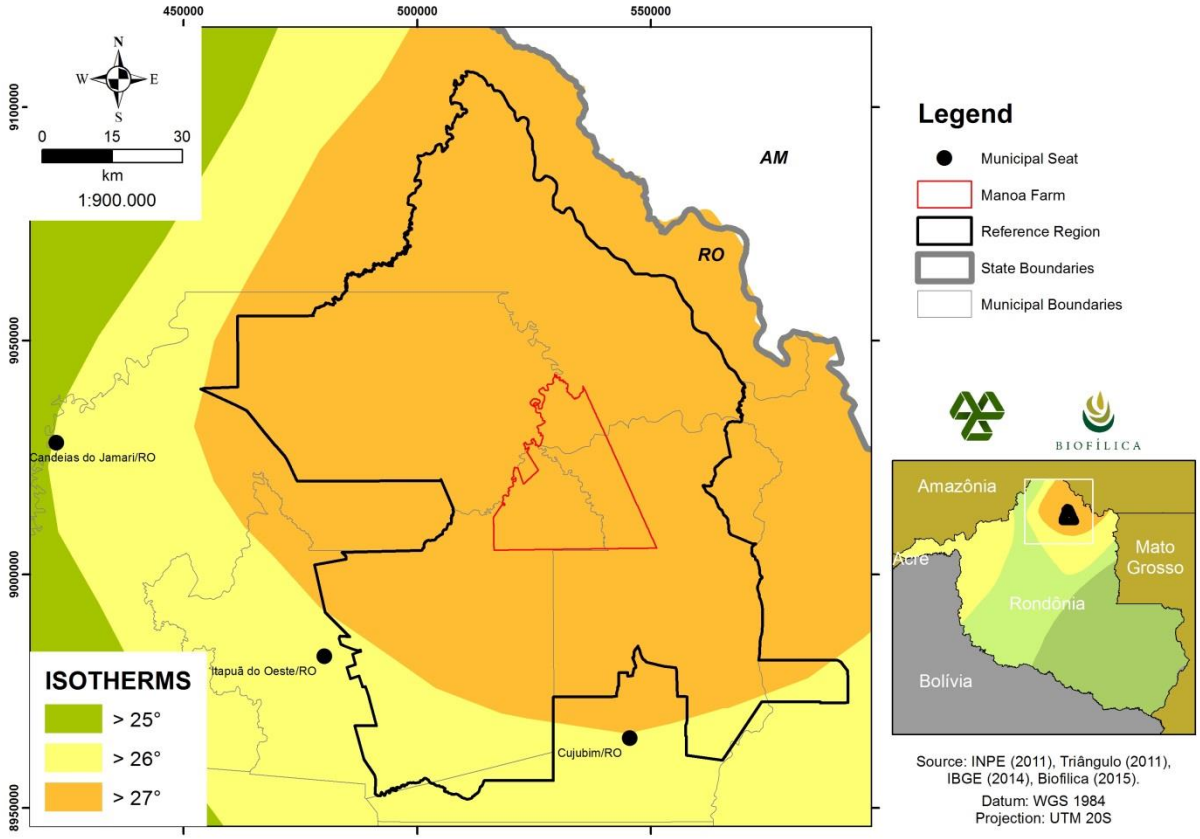


Figure 5 Average annual temperature in the Manoa Project reference region.

Hydrographic Aspects

The state of Rondônia is inserted in the Amazon Basin, sub-basin of Madeira River, where all state rivers converge. The main rivers of Madeira River sub-basin are Jamari, Machado (or Ji-Paraná), Guapore, Mamoré, Alto Madeira, and Abunã (Figure 6).

The reference region is partially composed of the Jamari River basin in the far west, by Machado River basin in the mid-east region, and by the high basin of Madeira River, in the far north (Figure 7).

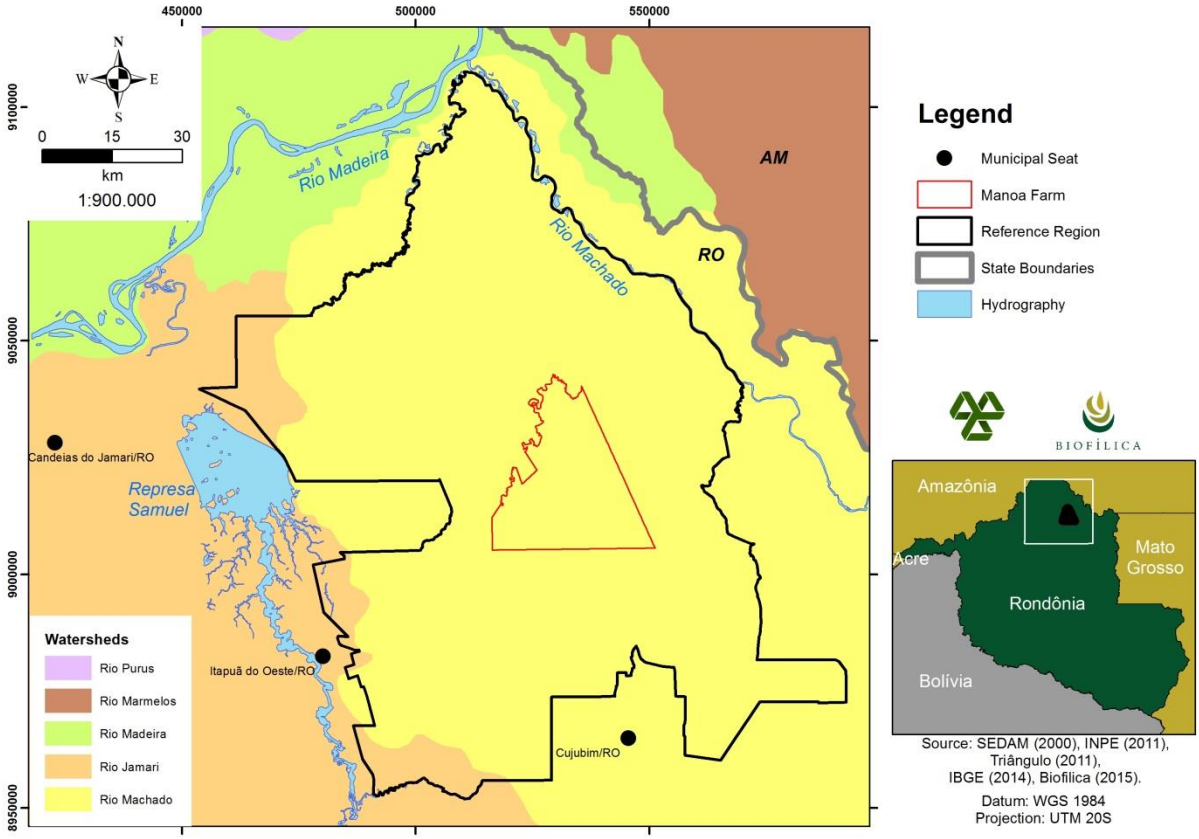


Figure 6 River basins in the Manoa Project reference region.

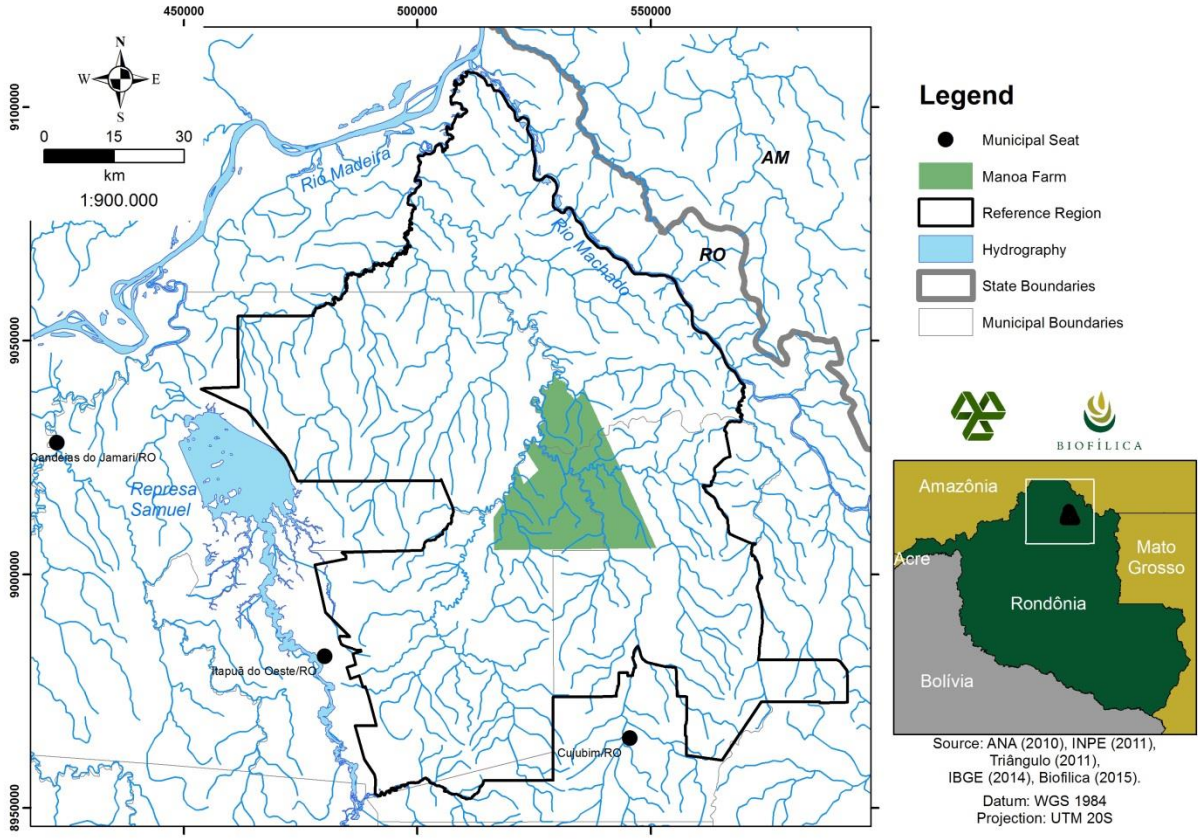


Figure 7 Map of the hydrographic network in the Manoa Project reference region

Pedological aspects

As a result of long lasting weathering and leaching actions, the sedimentary rocks and the crystalline basement found in the reference area during Neogene resulted in deep soils, such as Latosols, Argisols, and Espodosols, which predominate in the state of Rondônia (DANTAS; ADAMY, 2010 cited in CASA DA FLORESTA ASSESSORIA AMBIENTAL LTDA, 2015).

In the reference region, in Madeira River plains, there are Dystrophic Haplic Gleysols, Dystrophic Red-Yellow Latosol, Dystrophic Yellow Latosol, and Fluvic Neosols (SHINZATO et al., 2010 apud CASA DA FLORESTA ASSESSORIA AMBIENTAL LTDA, 2015) (Figure 8).

On the banks of the Madeira River and Jamari River lower, in the composition of Samuel HPP, we observe Eutrophic and Dystrophic Gleysols. Gleysols develop in saturated conditions, without the presence of dissolved oxygen, forming a Gleysols horizon, of gray and greenish colors. Eutrophic Gleysols have higher cations saturation exchangeable with plants, and the dystrophic ones have lower base saturation.

Yellow Latosols are found east and far west of the reference region, characterized by the yellowish color, due to the almost exclusive presence of goethite in the iron oxides in the clay fraction, resulting from high humidity in the region (Casa da Floresta, 2015).

Red-Dark Latosols are found in Cujubim's south-central, southern of the reference region, in the Formations of Santa Clara and Serra da Providência. (Casa da Floresta, 2015).

The Quartzarenic Neosols are found among the Yellow Latosols, at the Machado River banks, far east of the reference region. They have essentially sandy texture in all horizons and high to moderate acidity, with low saturation by bases and low fertility (Casa da Floresta, 2015).

Concretionary Dystrophic soils are found in the inselbergs of Serra da Providência, west part of the reference region, near Samuel HPP. They are characterized by the presence of petroplinthites (but in insufficient quantities to be defined as Plinthosol), originated from wetting and severe dryness, with formation of ferruginous nodules and concretions (SANTOS et al., 2013 cited in CASA DA FLORESTA ASSESSORIA AMBIENTAL LTDA, 2015). Small areas of Regolithic Neosols are found south-central of the reference region. Dystrophic Red-Yellow Argisols are found in the end south of the reference region. Dystrophic Haplic Cambisols are found east of the reference region.

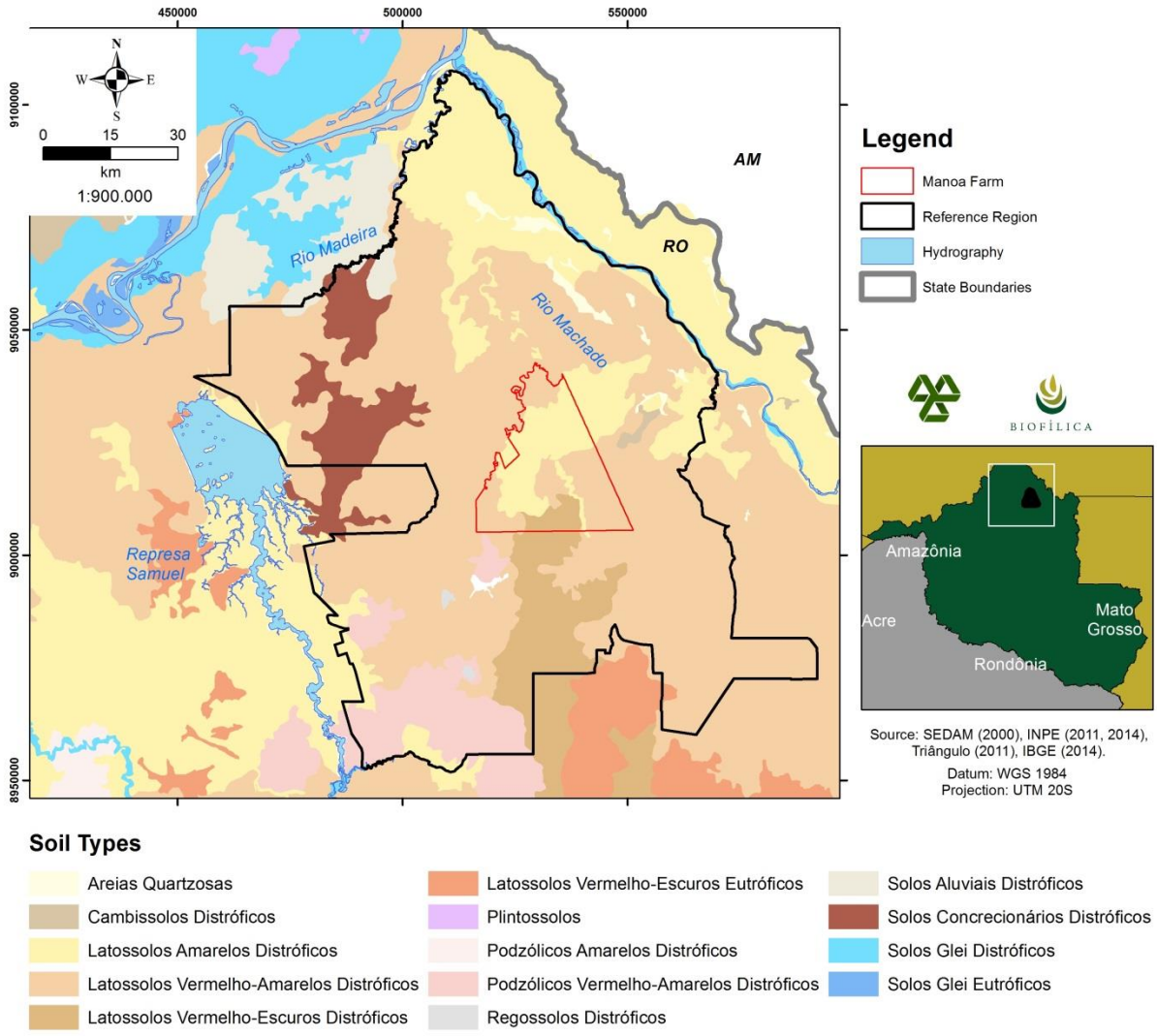


Figure 8 Pedology map in Manoa Project reference region.

Geological aspects

The state of Rondônia is inserted in the west/southwest region of the Amazonian Craton in Central Brazil Shield. The Amazon Craton is one of the largest Precambrian areas of the world, representing one of the main tectonic units of South America. Parnaíba, Xingu and Alto Tapajós, Parecis, Solimões, Tacutu and Amazonas are Phanerozoic basins located inside the Craton (Figure 9).

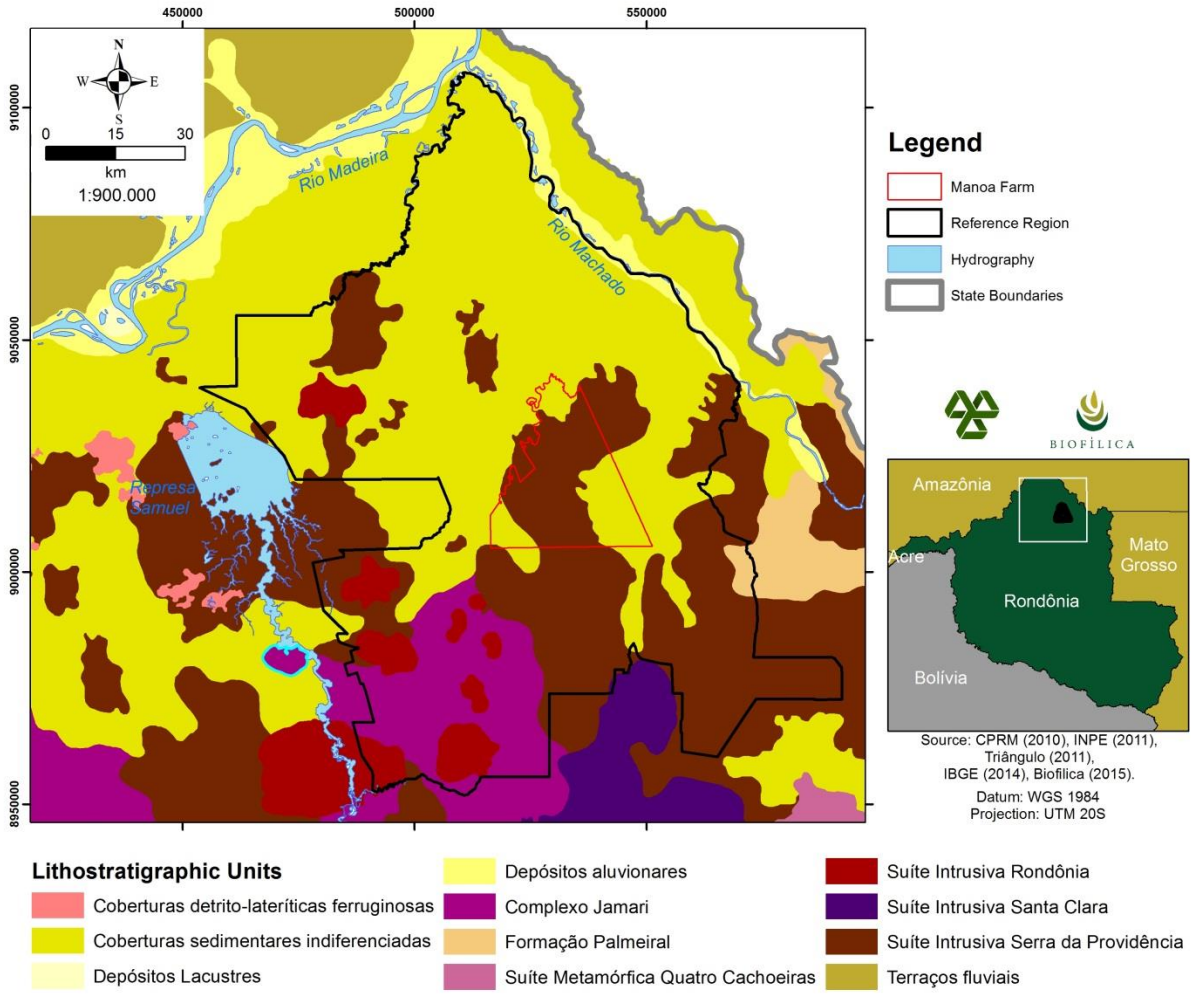


Figure 9 Map of the geology in the Manoa Project reference region

1.3.3 Socioeconomic parameters

The territory in which the State of Rondônia is located was initially exploited as a result of the discovery of gold in the areas of the Guaporé Valley in the 18th century. After a cycle of extraction of this ore the region started to suffer with the disinterest of the Metropolis, but the economic cycles are renewed and the region returns to arouse the interest in later moments.

The Municipalities of Porto Velho and Candeias do Jamari have their origin related to another moment of exploitation of resources of the region. In the nineteenth century the rubber extraction activity promoted the occupation of the rubber plantations in areas where latex rubber was extracted (MACEDO, 2000). Candeias functioned as a support point for those who were moving towards the rubber plantations in the Alto Rio Candeias, as well as a place where rubber production was stored.

The occupation of where it is currently the Municipality of Porto Velho also began as a result of the rubber extraction, because its urbanization occurred due to the installation of the construction site of the Madeira Mamoré Railroad, which was to drain the production of the Colonies of Territories (now Departments Of Pando and Beni, in Bolivia) and Amazonian to supply the European and North American market. This work was Brazilian counterpart by signing the Treaty of Petrópolis, where it was established the Brazilian responsibility to build a railway line that would facilitate the flow of Bolivian latex and Alto Madeira production in exchange for an area where today is the State of Acre.

The Brazilian Government-oriented occupation of the localities where the municipalities of Cujubim and Itapuã do Oeste are currently related to the strategy of occupying the Amazon through agricultural colonization projects (FEARNSIDE, 1989). In the 70's, the Military Government drafted the First National Development Plan. In this period the actions occurred through the discursive presence of a notion of the Amazon as an empty area, apt to be occupied by those who claimed land to produce. These measures partly dissolved derived social tensions claiming land for cultivation.

This period is marked by the famous phrase of former president Emílio Garrastazu Médici 'I want to open a road that takes landless men to a land without men', showing the Amazonian notion as an empty space that needed to be occupied. Ideology that directed a large migratory flow to the region largely peasants from the northeast and south of Brazil. There were numerous bibliographies produced during the 1970s and 1980s showing the impact of the expansion fronts in the north of the country and the great influx of migrants who moved to this border without finding any infrastructure there. (NASCIMENTO, 2007).

Table 2 Socioeconomic data of the municipalities of the Reference Region of the Manoa Project.

Data	Candeias do Jamari	Cujubim	Porto Velho	Itapuã do Oeste
Estimated Population 2014	23.573	20.204	494.013	9.831
Population 2010	19.779	15.854	428.527	8.566
Territorial unit area (km²)	6.843,868	3.863,943	34.096,388	4.081,583
Demographic density (pop/km²)	2,89	4,10	12,57	2,10
Human Development Index - 2010 (IDHM 2010)	0,649	0,612	0,736	0,614
PIB per capita - 2012	R$ 17.120,48	R$ 12.813,19	R$ 22.081,33	R$ 14.141,45

Source: IBGE - Brazilian Institute of Geography and Statistics

The region of the municipality of Cujubim until the mid-twentieth century was populated by several indigenous ethnic groups that disputed the territory, mainly with activities of hunting and fishing. However, it is not certain how many ethnic groups inhabited the space that the current municipal, being, however, pointed out the presence of the Arikem, Boca-Negras, among others.

Historiography and other studies indicate that in the late nineteenth and early twentieth centuries, indigenous people underwent a drastic change in their way of life and resulted in ethnocídios. The extraction of the syringe (Hevea brasiliensis) to supply the necessities of the wars, propitiated the insertion of the capitalism and provided to the seringalistas and merchants in general, great riches.

Thus in the region, the presence of the Northeastern worker in the rubber plantations and explorers of unknown territories and rivers inevitably caused the "meeting of societies" with different values and a series of confrontations resulted in the loss of indigenous territories.

In this tragic scenario, indigenous and rubber tappers were victims of the occupation process in the Amazon. The indigenous people were expelled from their territories and suffered from ethnocides, while the rubber tappers faced poverty, slavery, loneliness and death.

The 1950s presented itself as a new milestone for the region, consubstantiating population growth, since the entrance of mining, with cassiterite extraction in Ariquemes and Machadinho River Valley, attracted new social actors.

Since the 1970s, with the improvement of access to the region, especially through BR-364, official colonization of the State was inaugurated, first in the region of Ariquemes with the installation of two Directed Settlement Projects (PADs) of INCRA "Marechal Dutra" and "Burareiro", and in the following decade the Cujubim Settlement Project (PA) was established, which originated the municipality. In the 1980s, with the creation of the Machadinho, Cujubim and Buritis Settlement Projects, all municipalities in

this Territory were derived from these INCRA colonization and settlement projects, with the exception of Campo Novo de Rondônia, which originated from cassiterite exploration, from the 1950s (TEIXEIRA & OLIVEIRA, 2001).

The PADs and PAs clearly reflect the Amazonian occupation policy, as a geopolitical strategy adopted by the Brazilian state, which in this case provided the region with some propulsive infrastructures for the creation of these municipalities. Parallel to the action of the State, the logging activitie contributed significantly and directly to the expansion of deforestation, while offering "jobs" to a portion of the unemployed population without skilled labor.

Cujubim, has a territorial area of 3,864.07 km² (IBGE / 2010), its border to the north is the municipality of Porto Velho, south of Rio Crespo, east of Machadinho d'Oeste and west of Itapuã do Oeste. Its origin was given as Urban Support Rural Core - NUAR of the Cujubim Settlement Project and adopted the same name of the Project. It has a density of 4.10 hab / km² (IBGE / 2010) and was created by State Law 568 of June 22, 1994, signed by Governor Oswaldo Piana Filho, with areas of Rio Crespo and Itapuã do Oeste.

Cujubim is economically supported by agriculture, livestock and timber industry. Currently, the major suppliers of raw material for the timber industry are the Jamari National Forest and the MANOA Farm, which focuses on the territorial area of the municipality, and receive certification of forest origin, due to sustainable forest management plans.

In recent years, the timber sector has been undergoing a severe crisis due to the reduction of the stocks of timber available in private forests, as well as by the public agencies that control the illegal nature of predatory activity in the industries and consequently the closure of the companies and contributing with unemployment.

1.4 Project Proponents (G4)

Table 3 Identification and responsibility of Manoa REDD+ Project Proponents

ORGANIZATION	DESCRIPTION
Biofílica Investimentos Ambientais S.A (primarily responsible for the design and implementation of the project).	Biofílica Investimentos Ambientais is a Brazilian company that promotes the management of forest areas in the Amazon biome. The company was founded in 2008, striving to create pioneering alternatives and turn environmental conservation into an economically interesting activity for forest owners, communities, and investors. Biofílica's mission is to reduce deforestation and carbon emissions into the atmosphere, conserve biodiversity and water resources, and promote social inclusion and the development of communities that live in the Amazon biome. This mission is achieved by commercializing environmental services credits, by fostering and financing scientific research activities, and by developing sustainable business chains. **Responsibilities in the Project:** overall coordination of the socioeconomic and environmental diagnosis (DSEA), baseline studies and carbon stock; development and financing of PDD (Project Design Document); Remote monitoring of forest cover and implementation / coordination of additional actions aimed at reducing / mitigating greenhouse gas emissions (GHG); validation/verification and sale of credits; project co-management throughout its duration. **Contact Information** Plínio Ribeiro **Phone:** +55 (11) 3073-0430 **Email:** plinio@biofilica.com.br **Website:** www.biofilica.com.br

Triângulo Pisos e Paineis Ltda	Triângulo Pisos e Paineis is the owner of Manoa Farm, in the city of Cujubim, state of Rondônia, property in which Manoa REED+ Project is installed. Dedicated to wood industrialization since 1972, it strives to the responsible timber production, continuous product development, and forest protection with social responsibility. The company invests in the conservation of its native forests through responsible management. **Project Responsibilities**: Triângulo Pisos e Paineis Ltda. owns the land where the project will be implemented. Co-management and control of project activities. **Contact Information:** Douglas Granemman de Souza **Phone:** +55 (41) 2106-5113 **Email:** triangulo@triangulo.com.br **Website:** www.triangulo.com.br

1.5 Other entities involved in the project (G4)

Table 4 Identification and responsibility of other entities involved in Manoa REDD+ Project.

ORGANIZATION	DESCRIPTION
Casa da Floresta Assessoria Ambiental Ltda.	Casa da Floresta Assessoria Ambiental is a company specialized in biodiversity and sustainability research. Casa da Floresta holds 15 years of experience in environmental consulting area, and is nationally recognized for conducting high level work, always meeting the needs of its clients, without forgetting its mission and maintaining the quality of its products and services. The company's team is dynamic and of innovative character, composed of forest engineers, agronomists, biologists, ecologists, geographers, and social workers that integrate a skilled team of researchers and specialists able to conduct activities and

	environmental assessments in the different biomes and terrestrial and water ecosystems in Brazil; thus, combining scientific knowledge with its clients' needs. **Responsibilities in the Project**: Development of characterization studies on the physical environment and biodiversity assessment of Manoa REDD+ Project area. **Contact Information:** Eng. Florestal Me. Klaus D. Barretto - Forest Engineer - Master's Degree Agrônoma Ma. Mônica C. de Brito - Agronomist Engineer - Master´s Degree **Phone:** +55 (19) 3433-7422 **Email: Elson Fernandes de Lima <elson@casadafloresta.com.br>** **Website:** www.casadafloresta.com.br **Technical skills:** Casa da Floresta holds borad experience in the development of flora and fauna monitoring programs, especially for compliance with farming and forest certification requirements, including Standard FSC® (Forest Stewardship Council - ProForest) and Standard RAS (Red de Agriculture Sostenible - Rainforest Alliance), which are two of the most demanding and well-established standards in these sectors. Based on great demand for certifications, emerged from initiatives such as REDD+ and technical standards for food safety and sustainability, its activities have also been used for other types of certifications, such as ISCC (International Sustainability & Carbon Certification).
Ecoporé - Guaporé Ecological Action	Ecoporé-Guaporé Ecological Action is an environmental non-profit association. Founded in June 1988 to legitimize its actions, which were developed against predatory timber exploitation, to fight illegal deforestation and invasion of Conservation Units. The association has executed projects aimed at environmental conservation and sustainability, in partnership with governmental and non-governmental institutions and traditional populations. **Responsibilities in the Project:** Development of Socioeconomic and Environmental Diagnostic in Manoa REDD + Project Region.

	Contact Information: Marcelo Ferronato **Phone**: +55 (69) 3224-7870 **E-mail**: ecopore@ecopore.org.br **Website**: www.ecopore.org.br
Florestal - Planejamento, Paisagismo e Consultoria Ltda	It was founded in 1986 in the Ariquemes, state of Rondônia. With 28 years of experience in the forestry industry in Rondônia, the entity is dedicated to the management and use of forest resources. In addition to conducting forest inventory activities and preparing Sustainable forest management plan and the Annual Operational Plan (PMFS)/ POA), the entity is also responsible for technical support during exploration activities of its clients´ management projects, carrying out refreshing courses in Reduced Impact Exploration and Training in Safety at Work . **Responsibilities in the Project:** Development of Manoa REED+ Project Forest Carbon Stock Estimate study.. **Contact Information**: Eng. Fltal. Márcio José Lovatti - Forest Engineer **Phone**: +55 (69) 3535-4501 **E-mail:** florestal@florestalro.com.br **Website**: www.florestalro.com.br
HDOM Engenharia e Projetos Ambientais Ltda.	Founded in 2009 in the city of Manaus, state of Amazonas, Hdom Consultoria Ambiental is a dynamic and multidisciplinary consulting company specialized in providing a set of solutions in environmental education, biodiversity, and forestry. The company provides services throughout Brazil and abroad, always looking for support, developing with the client. **Responsibilities in the Project:** Manoa REED+ Project Baseline Development **Contact Information**: Mateus Bonadiman, M.Sc. **Phone**: +55 (92) 98128-3936 **E-mail**: mateus.bonadiman@hdom.com.br **Website**: www.hdom.com.br

1.6 Project Start Date

Manoa has been carrying out actions to avoid deforestation and degradation in its area mainly through the Forest Management activity, ensuring effective physical presence and occupation within the limits of the Farm since the beginning of its Management Plan in 1997.

Historically, Manoa has adopted strategies to prevent invasions by deforestation agents and ensure the maintenance of forest integrity, however in the years prior to the project, strong deforestation pressure, fragility in property security and risk of invasion were identified, which has been increasing year by year, due to the context of the Region of Reference. In order to contain the pressure identified, strategies were adopted, such as: the exploitation of forest management in the north of the farm and in other areas of greater risk, block access roads in remote areas, and permanent watch in areas where greater fragility was identified.

In the same period, in parallel to the strategies to prevent invasions with deforestation and forest degradation, the company started a plan to work directly with social actors in the region, through the construction of a training center inside the property, CEFLOM, whose main objective would be to train local agents in forest management techniques and to work on environmental education concepts with schools in the region.

The construction of the training center, as well as the reform of surveillance houses and the forest management in vulnerable areas occurred in the period from 2012 to 2013, and in the beginning of 2013 the first studies of the Biofílica took place to evaluate the possibility of structuring a REDD+ project. Based on this historical context, the proponents chose January 1st, 2013 as the project start date, which represents the milestone for the beginning of the planning directed to the implementation of the REDD+ project activities.

1.7 Project crediting period (G3)

The crediting period is January 1st, 2013. The finish date will take place on December 31, 2042, completing the 30-year period.

The activities will be developed throughout the project crediting period, as detailed in item 2.2 Description of Project activities.

2 DESIGN

2.1 Sectoral scope and project type

- Sectoral Scope: 14 - Agriculture, Forestry and Other Land Use (AFOLU)
- Reducing Emissions from Deforestation and Forest Degradation (REDD)
- Methodology for Avoided Unplanned Deforestation (AUD)
- This is not a clustered project.

2.2 Description of project activities (G3)

In order to avoid greenhouse gas emissions from deforestation and forest degradation, as well as generating net benefits to local populations and biodiversity beyond the project's duration, long-term activities were planned and some of them already implemented (Table 5):

Activities for the Climate:

According to the Project Description, section 1.1, the objective of the project for the climate is to avoid the deforestation of 22,118 hectares, corresponding to a total of 8,378,697 tons of CO2e, which will avoid to be emitted into the atmosphere by means of following activities:

- Monitoring of deforestation by satellite images: Regular annual monitoring of deforestation will be carried out by satellite images. This monitoring will result in bulletins with the points of deforestation that will be sent to the other proponents, in this way the remote monitoring will serve as support for the strategic plan of patrolling in the field. This action is directly related to containment of deforestation and invasions, maintenance of forest cover and, consequently, maintenance of the climate benefits provided by the scenario with the project.
- Physical patrol of the area: Surveillance activities will be carried out by the Triângulo surveillance team. The Project aims to intensify and improve the efficiency of this patrol through the availability of bulletins of deforestation and costing of logistics items of operations. The plan to combine patrolling activity with remote monitoring by satellite images aims to develop unified strategies that provide greater efficiency in surveillance and strengthening security in the area limits. In this way, these actions aim to guarantee the maintenance of the forest cover and the carbon stock in the area and, consequently, maintenance of the climate benefits foreseen by the scenario with the project.

- FSC certified forest management: Under the responsibility of the Triângulo Group, FSC Management aims to exploit forest resources in a rational manner, through the use of reduced impact harvesting systems, associating forest permanence, maintaining ecological balance, social and environmental responsibility and economic efficiency. The methodology used in the planning and execution of FSC Management fits the requirements contained in all relevant regulations and legislation. Exploration planning is based on information on the structure and composition of the forest and the demand for raw materials. The development and methodological basis of the FSC Management are based on a previously conducted forest inventory, allowing the extraction does not exceed the natural regeneration capacity of the forest.

Activities for the Community Groups:

According to the Project Description, section 1.1, the project seeks to generate benefits for the local community aimed at supporting socioeconomic development with sustainable bases and environmental awareness of families living near Manoa Farm in Cujubim, and students from the region. Through the activities carried out with the local community, the project intends to promote actions that enhance the standing forest, providing training, workshops, courses and lectures focused on the responsible management of environmental resources. The planning includes quarterly activities (four times a year) involving a maximum of 30 people (when carried out at CEFLOM), such activities should be focused on topics related to sustainable socioeconomic development, such as: Interventions with schools in the region to hold lectures/seminars and workshops on environmental education; Support in the training of skilled labor to operate in the certified timber and non-timber forest management chain; Lectures/seminars and mini-courses directed to the implementation of agroforestry systems (SAFs), Techniques for Low Carbon Agriculture (ABC) and recovery of degraded areas; Training in management, leadership and public policies directed to local associations; Among others. Always seeking to promote economically viable, attractive and sustainable initiatives.

A large part of the actions related to training and lectures will be held at CEFLOM, a training center built at the Manoa farm, which has been dedicated to this purpose. In addition, in order to complement the social action proposal effectively and close a cycle involving training and monitoring, the project plans to partner with local organizations to offer technical follow-up to the actors participating in the activities, as well as to support local associations to promote their own development.

In addition to the maintenance of carbon stocks through the reduction of deforestation, the project seeks to encourage the change of the conventional agricultural production system, promoting the recovery of degraded areas through the diversification of the productive system and stimulating the implementation of Agroforestry Systems combined with Low Carbon Agriculture. With the project, it is possible that social, economic and environmental conditions will be strengthened, especially in the municipality of Cujubim, as it is believed that through these actions several other initiatives can be triggered in the region, generating several direct and indirect positive impacts. In terms, the REDD+ Project emerges as an important opportunity for the local community to generate business with sustainable bases, and especially to maintain the integrity of forests.

Activities for the Biodiversity:

The project aims at maintaining the forest cover of the project area along with the development of low impact forest management activities, which will ensure the protection of habitats in the Manoa farm area. There will be constant monitoring of high value attributes for conservation, since the diagnosis made shows that the Project Area is habitat of 177 species of flora and more than 360 species of fauna identified, 12 of mammals and 9 of birds in National and international lists of endangered species; Manoa farm also plays the important role of "ecological corridor", which integrates the connection between several Conservation Units, mitigating negative impacts of the degradation of the region.

The project plans as activities related to biodiversity, the Biodiversity Monitoring and the Realization and encouragement of scientific researches in the project area. These activities consist in the elaboration of a long-term monitoring plan of the impacts of the project and the sustainable forest management in the regional biodiversity. Such monitoring should preferably be carried out through agreements with local educational and research institutions, so as to provide the incentive to research and disseminate scientific and environmental knowledge to local society. In this way, the dissemination of this monitoring and among other studies fomented by the project is not only allowed but also encouraged by the proponents.

In this way, the project is expected to generate the following impacts on biodiversity:

- Conservation of species already diagnosed;
- Generating knowledge on biodiversity through long-term monitoring;
- Dissemination of scientific studies carried out in the area and results and indicators related to biodiversity;

- Maintenance of ecosystem services;
- Conservation of HCVs; and
- Mapping of new relevant areas and maintenance of connectivity in the landscape;

Table 5 Manoa Project REDD+ activities and respective processes, results and impacts.

Climate	Community	Biodiversity	Activities	Process	Results	Impacts	Períod of implementation
X	X	X	Initial articulation: Identification of actors and choice of research institutions	Number of meetings held; Contracting and formation of partnerships;	Institutions and actors initially aligned on the project; Diversification and integration of a multidisciplinary team;	Maintaining relationships throughout the Project; Knowledge generation on conservation and REDD +;	Held in February/2014
X			Carrying out the forest carbon stock estimation study	Technical Report Generation	Generation of knowledge about the carbon stock, including differentiation between managed and unmanaged areas; Contribution to the accounting of reduced emissions;	Generation of inputs for future monitoring; Improvements in the timber forest management system; Identification of priority areas for the conservation of stocks;	Held in March/2015
X			Conducting the study to determine deforestation baseline	Generation of technical report of future deforestation;	Generation of knowledge on the dynamics of deforestation in the region; Contribution to the accounting of reduced emissions;	Generation of inputs for future monitoring; Tool for prevention and containment of deforestation in the project area;	Held in May/2015
	X	X	Carrying out the socioeconomic and environmental study;	Technical Report Generation	Knowledge about the socio-environmental dynamics of the region; Supply of inputs for the design of interventions and impacts;	Improvement of social conditions; Prevention of deforestation in the project area; Deepening in the scientific knowledge in the area;	Held in February/2015

Climate	Community	Biodiversity	Activities	Process	Results	Impacts	Período of implementation
X	X	X	Conducting workshops with researchers and proponents to present results and design activities	Number of meetings held; Number of participants;	Sharing knowledge; Alignment of core project issues; Design of activities and causal relationships;	Continuity of partnerships throughout the project; Deepening scientific knowledge in the area;	Held from July 2014 to February 2015
X			Monitoring deforestation through satellite images (Landsat and Resourcesat) and generation of annual bulletins;	Mapping of the deforested area in the Project Area and its surroundings by means of a semiautomatic soil classification tool;	Optimize the process of determining areas at risk and decision making; Enhancement of knowledge on the dynamics of deforestation in the region; To increase the effectiveness of the fight against illegal invasions and activities carried out in the project area and in the areas close to probable displacement of agents and vectors;	Maintenance and increase of forest cover; Reducing emissions from deforestation and forest degradation; Mitigation of global climate change;	Started in 2014, annual throughout the project.
X			Patrimonial Surveillance	Number of rounds performed; Systematization and strategic alignment with the remote monitoring activity; Identification of probable deforestation agents and invaders;	Better understanding of the dynamics of deforestation in the environment and adaptation of project activities; Refinement of remote monitoring by field check; Prevention of deforestation and degradation;	Maintenance and increase of carbon stocks; Reducing emissions from deforestation and forest degradation; Mitigation of global climate change;	Started in 1997 and continued throughout the project with the support of the resource generated

Climate	Community	Biodiversity	Activities	Process	Results	Impacts	Período of implementation
X		X	Low Impact Forest Management, FSC-certified	Forest exploitation according to sustainable practices; Quantity of wood marketed; Physical presence of the company in the area;	Maintenance of forest cover, biodiversity and HCVs; Source of revenue to finance the activities of the company; Job creation and direct influence in the regional economy;Garantia de presença física na área;	Maintenance of forest cover and attributes of high conservation value.	Started in 2005 and continuous throughout the project
X	X		Political / institutional articulation between public agencies and private entities	Participate / support participation in at least 1 conservation unit council and 1 city / state council Provide support and technical support to public and private institutions in forest concession areas Signing at least 1 partnership / year for productive / social activities in the municipality of Cujubim	Inciding together with councils of Conservation Units adjacent to Manoa Farm and Municipal / State Councils Promotion of responsible forest management in the region. Strengthening of the sector and conservation of the Flonas in surrounding Establishment of public-private partnerships with local agents	Acting in articulated way with other agents of environmental protection aiming at mitigating the action of agents and vectors of deforestation in the region.	Continuous throughout the project. Prediction of beginning in January/2018
	X		Promoting socio-environmental education actions in the municipality of Cujubim	CEFLOM's political pedagogical project; Quarterly activities with a maximum of 30 people;	Political Pedagogical Project built in a participatory manner with local actors; Use as an instrument for socio-environmental training;	Medium and long-term change in the positioning of the local population in relation to socio-environmental issues.	Continuous throughout the project. Prediction of beginning in April/2018

Climate	Community	Biodiversity	Activities	Process	Results	Impacts	Período of implementation
				Carry out educational activities in urban and rural areas; Accompanying calendar of environmental dates;	Increased number of people getting information about socio-environmental issues in the municipality and acting as multipliers;		
X	X	X	Technical training in low-impact forest management	Bimonthly Training at the CEFLOM Training Center	Agents from public agencies and industry workers trained in technical and environmental issues	Conservation of forest remnants through the strengthening of forest management activity; Public agents more qualified to work in other forests of the state; Dissemination of sustainable management techniques among local community actors;	Continuous throughout the project. Prediction of beginning in April/2018
X	X		Technical training in Agroforestry Systems (SAFs), Low Carbon Agriculture (ABC), among other sustainable development initiatives.	Annual courses and lectures at the CEFLOM Training Center; Interventions with local associations and cooperatives;	Local actors trained in practices aimed at the valorization of forest resources as an environmental asset and a tool for sustainable economic development; Promotion of changes in the conventional productive system by stimulating the use of techniques of direct planting, crop-livestock-forest integration, among other alternatives;	Increase and diversification of agricultural productivity for small and medium producers; Recovery of forest areas and degraded pastures through the implementation of SAFs and ABC techniques;	Continuous throughout the project. Prediction of beginning in April/2018
	X		Workshops for continuous training in modules for workers on REDD+, Environmental Education and Workers' Rights	Train all farm workers and outsourced companies;	Workers aware of their labor rights, the importance of education and environmental preservation;	Farm workers acting as multipliers of good socio-environmental practices.	Continuous throughout the project. Prediction of beginning in April/2018

Climate	Community	Biodiversity	Activities	Process	Results	Impacts	Período of implementation
	X		Partner with local organizations / companies / entities, with expertise in the process of advising local associations and small producers.	Advise at least 2 rural associations around the Manoa farm and/or the municipality; To train at least 3 representatives from each supported association (Management, Leadership, and public policies. Provide technical follow-up for the rural producers participating in the training.	Strengthening of local social organization and support for socioeconomic development; Provide for the adequate implementation of the initiatives proposed during the activities;	Associations acquiring autonomy in the management and its representations and focusing on local public policies; Transformation of the activities and initiatives proposed by the project into concrete actions;	Implementation in a period of 3 years. Continuous follow-up throughout the project. Prediction of beginning in April/2018
	X		Annual evaluation of the social activities developed by the project.	Presentation of the annual report of activities and evaluation of indicators and results of actions; Planning of activities for the following year;	Joint evaluation of the interested parties regarding the impacts generated by the actions carried out in the previous year; Refinement of evaluation and planning methods for the following year;	Improvement of the project evaluation process; Refinement of data collection methods; Improvement of the feedback process with stakeholders;	Continuous throughout the project. Prediction of beginning in April/2019
		X	Birds Monitoring	2 annual systematic field campaigns	Knowledge of local richness	Biodiversity conservation	Continuous throughout the project. Prediction of beginning in April/2018

Climate	Community	Biodiversity	Activities	Process	Results	Impacts	Período of implementation
		X	Mammals Monitoring	2 annual systematic field campaigns	Knowledge of local richness	Biodiversity conservation	Continuous throughout the project. Prediction of beginning in April/2018
		X	Monitoring of endangered species	2 annual systematic field campaigns	Maintenance of key species	Maintenance of the gold level	Continuous throughout the project. Prediction of beginning in April/2018
		X	Monitoring of the HCV "Salt lick" (HCV 1 e 3)	2 annual systematic field campaigns	Maintenance of HCVs	Maintenance of key resource for species	Continuous throughout the project. Prediction of beginning in April/2018

2.3 Project benefits risk management (G3)

The risks to climate benefits, both natural and human-induced, were measured using the tool "AFOLU Non-Permanence Risk Tool v3.2", reported in the "Manoa REDD+ Non-permanence Risk Report" according to summary table below (Table 6).

Table 6 Non-permanence risk final score

Category	Score
a) Internal risk	2
b) External risk	0
c) Natural risk	0
Overall Score (a + b + c)	**10**

The risks to climate, community (and Other Stakeholders) and biodiversity benefits are listed in Table 7 below, with the respective mitigation measures.

Table 7 Risks to project benefits and mitigation measures

Risk	Mitigation
Problems in the commercialization of carbon credits, due to credit price variations and absence of a regulated market, and consequent lack of resources for financing proposed activities.	One of Biofílica roles in the project is to provide funds to credit sale, publishing dissemination materials and keeping constant contact with key market players and potential buyers, establishing a contact network of contacts essential to the sales commercialization effort. Moreover, alternative financing options, such as donations and partnerships for direct implementation of project activities (not necessarily linked to credit sales), will be sought by the applicants.
Lack of interest of the society, research agencies, and other stakeholders	Integrate stakeholders in the project decision-making processes.

2.4 Project governance

The project will be managed by Biofílica and Grupo Triângulo, the parties will have the following obligations concerning the project:

(i) Compliance with Convention 169 of the International Labour Organization, with the Federal Constitution and current legislation, aimed mainly at ensuring respect for the social, cultural, political, and environmental rights;

(ii) keep the coordinators previously indicated by the respective Parties to represent and monitor the Project implementation;

(iii) Keep the other Party updated on the progress of the work activities, forwarding, in a timely manner, all reports and providing relevant information toward the project progress.

The project governance responsibility for Grupo Triângulo:

(i) Reflect internally, develop and implement, in a participatory manner, a socioeconomic transition plan to avoid unplanned deforestation and ensure the Property conservation, meeting expectations of an emission reduction project from deforestation and degradation (REDD+), and ensuring long-term benefits to the Property and Society;

(ii) Monitor and supervise the Project implementation, to meet the proposed objectives;

(ii) Represent the Property in the Carbon Project construction, as a proponent entity;

(iv) Monitor and support activities performed by Biofílica technicians and its associates;

(v) Support Biofílica in the development and implementation of local development plans and other property conservation actions;

(vi) Monitor Carbon Project activities in partnership with Biofílica;

(vii) Keep the Environmental Development Secretariat of the State of Rondônia - SEDAM and other public institutions properly updated on the Carbon Project progress;

The project governance responsibility for Biofílica:

(i) Conduct Initial and Complementary Investments, provide technical support, including legal, to the formulation and implementation of the Project, and conduct the negotiation and sale of Property of carbon credits to third parties, all in compliance with Sections Two and Third mentioned above;

(ii) Provide information and training on payment systems for environmental services, especially concerning forest carbon market, to the Property Owner, with information and knowledge necessary for the assessment and negotiation with potential buyers and other market sectors;

(iii) prepare the Property PDD, incorporating technical data provided by the partner organizations of this initiative;

(iv) Contribute to partners in the PDD overall development and support the elaboration of a funding approach for an emission reduction project due to deforestation and forest degradation, for forest conservation, sustainable management, and carbon stocks increase (REDD +).

(v) Coordinate the activities planned by the project and carry out the contracting of third parties to implement specific activities, always on the supervision of the responsible professionals of the Triangle Group.

(vi) Carry out monitoring of forest cover throughout the expected duration of the project and implement/coordinate additional activities aimed at reducing / mitigating greenhouse gas (GHG) emissions, as well as preparing monitoring reports for submission to the auditors during verification events;

2.5 Project financing (G3 & G4)

Manoa REDD+ project initial activities, developed between 2013 and 2016, were financed with private investment provided by Biofílica. Annual investments provided by Biofílica's resources are programmed from the first generation of credits, aimed at expenses of subsequent verifications and of deforestation monitoring.

Striving to ensure the remaining activities and the generation of positive net impacts on climate, community and biodiversity, the funding will be made through the sale of carbon credits in the voluntary market, avoiding the emission of 1.800.699 t CO2eq in the first 10 years of the project, and a total of

8.378.823 t CO2 by 2042. The verified credits enable the maintenance of a cash flow to support the proposed activities and to sustainability to those in progress.

2.6 Job opportunities and safety at work (G4)

2.6.1 Relation with workers and trainings

Manoa LTDA, prioritizes the hiring of workers in the municipality of Cujubim (Figure 10), as well as seeking to strengthen the local economy by selling part of the wood to beneficiation and commercialization companies located in the locality. In the area of the Farm were interviewed 15 people between employees and outsourced, occupying services of forest management and monitoring and maintenance of the farm.

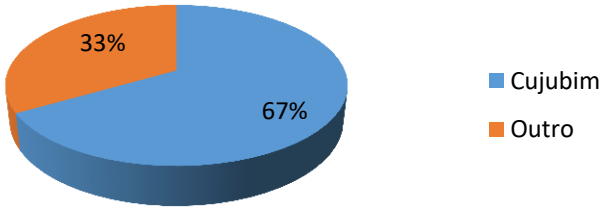


Figure 10 The majority of farm management employees live in the municipality of Cujubim.

Source: ECOPORÉ, 2014

Fieldwork has shown that the activities of wood extraction and handling of machinery in forest management are restricted to men, although the company does not object to the hiring of women. We verified the presence of women in the activities of the Farm acting as cook. There are also women working in the company's office, located in the urban area of Cujubim.

In the field work, two Internal Commissions for Accident Prevention (CIPA) were identified, one for the wood extraction workers and the other for the sawmill workers (currently the sawmill, located in the Municipality of Cujubim, is partially disabled).

The same field study mentions the fact that after the time spent in Manoa Farm, the worker, if he or she works in another forest management, has already lived in Manoa working within the standards required by labor laws and certified management , which strengthens their capacity to claim previously unknown rights.

Manoa farm has as one of its objectives the training of its employees, visitors and other stakeholders, with a primary focus on periodic training programs and retraining of employees and third parties on low impact forest management techniques and pertinent environmental issues.

Most of the workers interviewed revealed that the Manoa company offers training for employees. The training topics mentioned in the interviews were: first aid, chainsaw operation, log measurement, work with machinery, knowledge of forest species, prevention of accidents.

Table 8 Course themes offered for Manoa employees.

CURSOS FORNECIDOS PELA EMPRESA AOS TRABALHADORES PRÓPRIOS E TERCEIRIZADOS DENTRO E FORA DA AMF
Cipa
Primeiros Socorros
Uso de Epi's
Operação com Motoserra
Operador de Carregadeira
Prevenção e combate de Incêndios
Segurança no Trabalho
Exploração de impacto reduzido

The REDD + Project aims to attend the training of Manoa workers and outsourced companies in matters related to forestry conservation projects and payment mechanisms for environmental services. The objective is to train agents who recognize the importance of the project and become multipliers of the knowledge transmitted by the educational actions linked to the REDD + Manoa Project.

2.6.2 Health and safety

Triângulo Pisos e Painéis Ltda. perceives work health and safety as primordial aspects of the company's daily activities. Therefore, it fully complies with the Occupational Health Medical Control Program (PCMSO), carrying out medical evaluations on employees at admission, annually, return to work, on leave of absence exceeding 30 days, and in case of dismissal. The company also complies with the Environmental Risks Prevention Program (PPRA), which monitors and proposes measures to reduce the risks related to each work activity.

Several activities part of responsible forest management operations entails risks to the health and safety of workers, such as those performed in cutting tree areas, loading patio, concentration patio, and supply area. Striving to ensure health and safety of workers, the company has a general procedures

manual for forest management (Douglas A. Grenemann de Sousa and Industria de Madeiras Manoa Ltda., 2012), which must be followed by all employees.

The manual describes the mandatory use of safety equipment for each function, procedures for properly and safely perform each activity, instructions on proper disposal of waste, hygiene measures, and others. The manual also describes the health and safety monitoring plan at the workplace, which is summarized in an internal semi-annual audit conducted by Manoa/Douglas, followed by meeting between the forest engineer and the third party company to inform nonconformities and deadlines of corrective actions. After the deadlines, another meeting is held for concluding the corrective actions.

Among the audited items are food products, quality of water provided, living conditions in the camps, occupational health programs, ergonomic conditions of activities, provision of environmental risk prevention program, training, workers transportation, fuel transportation, hazardous areas communication system, machinery and equipment condition, and rest period between working shifts.

2.6.3 Anti-discrimination

It was identified during the project development process that Manoa Farm does not have a formal procedure or internal Code of Conduct to address issues of gender, race, creed, sexual orientation or sexual harassment. To address these issues employees have reported that the farm keeps the communication channel open between employees so that any claim in this regard is identified and handled in the most appropriate manner.

In this sense, the REDD+ project should adopt as a strategy the strengthening of the communication channel, including the theme in the evaluation questionnaires to be applied during the project activities, in order to reinforce this theme and mitigate possible related negative impacts. The statements and /or complaints will be handled jointly through the conflict management procedure adopted by the project.

2.7 Stakeholders (G3)

Biofílica ordered a socio-economic and environmental assessment of the project area to Ecoporé - Ação Ecológica Guaporé (Ecoporé), which identified the population nearby Manoa Farm who could be affected by the project.

The diagnosis was based on literature data and information obtained from the municipal administrations and government departments of cities in the reference region, except for Cujubim, which also provided primary data. Primary data were collected through open and closed questions questionnaires applied on three groups of the study population: rural and urban areas and farm workers.

The choice to collect data in the city of Cujubim was made as the city undergoes direct social and economic impacts from Manoa Farm, once the access, job generation, and allocation of raw material (wood) take place in this city.

Ecoporé observed in the regions surrounding Manoa Farm the presence of large farms conducting cattle raising and soybeans activities, as well as small farmers producers of milk, cocoa, coffee, and subsistence agriculture, in addition of fish farming, which has been attracting new producers to the region. The practice of incorporating small farms to large farms was also observed. The small farmers, unable to keep their activities due to the lack of soil productivity, lack of resources to invest in property, combined with lack of public policies on health, education, and technical assistance, end up abandoning or selling their land to large farmers, and move to areas still covered with forest, restarting the deforestation cycle.

The city of Cujubim counts on 72 timber business units, which, only in 2013, processed 354,000 m^3 of wood.

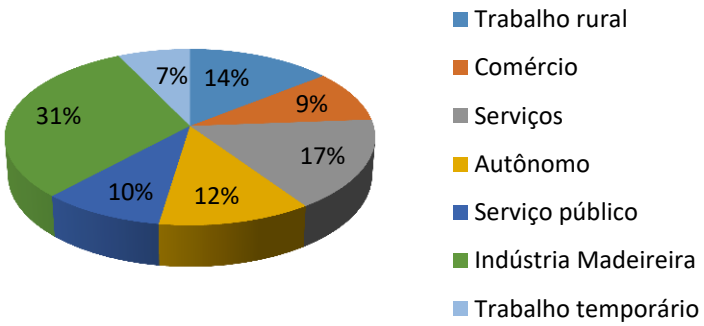


Figure 11 Source of income of the population interviewed by Ecoporé in the urban area of Cujubim, state of Rondônia.

There were no traditional peoples and communities located, according to definition given by Decree No. 6,040, of February 7, 2007, which established the National Policy for the Sustainable Development of Traditional Peoples and Communities, with exception of remaining rubber tappers located around FLONA Jamari, nearby Itapuã do Oeste, as well as large Riparian communities along Madeira River and Machado River.

These communities, although located in the reference region, have no connection with the project area; thus, they are located outside the project area, and there is no actions or programs available to these populations (Ecoporé, 2015). In this way, the following listed stakeholders were included in the category of "Other Stakeholders".

Table 9 Relative influence and interest of project stakeholders.

Stakeholders	Interest in the project	Influence	Significance
Sawmills of Cujubim	Maintenance of timber supply from the project area	Low. Demand for local raw material	Critical. As a source of employment, if they close their activities the labor force moves to illegal logging.
Public Intuitions of the Municipality	Collection of additional taxes and contributions on the issue of environmental education	Average. May require greater participation in the direction of educational activities	Moderate. It can facilitate public policies aimed at conservation and contribute to the implementation of the activities
SEDAM	That it serves as a model for other private properties in the state of Rondônia, including providing training on forest management.	Average. It may require greater participation in directing environmental and social activities.	Critical. Institution authorizing POAs (Annual Operational Plan)
Large and medium-sized owners of farms	Maintain good relation with Fazenda Manoa.	Low. Project may request support from these actors in the development of activities.	Significant. Productive activities can impact the project area.
Small farmer owners	Generation of employment and technical assistance projects for small farmers.	High. They are part of the target audience in the training actions.	Significant. The participation of these actors is part of the scope of some project activities.
Universities and researchers of the	Take advantage of the rich biodiversity that the project	High. They will monitor project interventions	Moderate. Its activities are part of the project

state of Rondônia	helps to preserve for research, in addition to contributing to proposed courses and training.	showing their effective results.	scope.

2.7.1 Procedure for public consultation

In order to attend the public consultation, in the period prior to the field audit, the teams of Biofílica and Ecoporé visited public institutions and social organizations previously mapped in the field in 2014, taking the REDD+ Manoa project summary and a summary of the socioeconomic study carried out previously , as a way of returning the results.

Seeking to facilitate the sending of comments on the CCBA website, a printed guide with the steps and contacts of the proponent and the auditor was delivered and explained.

2.7.2 Communication procedure, complaints and dispute resolution

As an integral part of participatory and adaptive management for social activities, a permanent channel of communication becomes necessary, especially with regard to possible conflicts that may arise with stakeholders and other actors who join the project directly or indirectly over time. The REDD + Manoa Project provides for the preparation and implementation of a formal procedure for conflict resolution with stakeholders, taking into account the local reality.

The Manoa farm brings in its manual of procedures a stage of relationship with social actors of the environment, which includes a stage of identification of conflicts and preventive measures to this theme, where a public ombudsman channel is already used.

The identification of the conflict begins by the verification of the potential occurrence through the identification of the local actors and the situations likely to conflict. Conflict prevention is based on the communication channel established between Fazenda Manoa and interested parties, publicizing the activities carried out in the area and indicating the open ombudsman channel. In this case, the activities of the REDD+ Project should make this communication more constant and focused on conservation activities, reaffirming the existing ombudsman channel.

The project plans to treat conflict management through a committee formed by Biofílica, Manoa and Ecoporé, which will analyze the complaints received. When complaints are related to the Manoa farm, the committee shall notify all interested parties and then deal with the applicable measures within

30 days. Such claims, when occurring within the property, will be collected by the farm managers and communicated to the committee.

Regarding the courses and capacities, or actions taken with schools, associations in the region, the criticisms and suggestions will be collected through questionnaires distributed during the activities, and the data collected will be analyzed by the committee during the annual evaluation of the activities. In this case, it is the responsibility of Biofílica to collect and systematize such information for submission to the committee. Although the official channel of communication is the ombudsman's office, verbal complaints or other means will also be considered and addressed.

2.7.3 Commercially sensitive information

The information below is considered commercially sensitive and are only made available to validators/verifiers. They are confidentially and not available to the public.

- Project budget;
- Financial projections;
- Triângulo financial statements;
- Biofílica financial statements;

Agreements and contracts held between the parties involved.

3 LEGAL STATUS

3.1 Compliance with laws, statutes, property rights, and other regulatory frameworks (G4 & G5)

Compliance with Laws, Statutes, and with other relevant regulatory bodies to the project are mostly linked to forest management activities. In the State of Rondônia, the project activities are licensed by the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA), along participation of the Environment State Department (SEMA-RO), so applicable laws are at federal and state levels. The state law is applied secondarily to federal legislation.

Manoa obtained its first FSC certification in late 2005, for management operations and chain of custody, becoming the first FSC certified forest management area in the State of Rondônia. The following FSC Principles were required to obtain the certification:

Principle 01: Obedience to FSC Laws and Principles.

Principle 02: Responsibility and Right of Ownership and Land Use.

Principle 03: Rights of Indigenous Peoples.

Principle 04: Community Relations and Workers' Workers.

Principle 05: Forest Benefits.

Principle 06: Environmental impact.

Principle 07: Management plan.

Principle 08: Monitoring and Evaluation.

Principle 09: Maintenance of High Conservation Value Forests.

Currently, there are no specific regulations for REDD+ activities. However, there is a background of construction and negotiation of the concept and configuration of these initiatives, based on the English United Nations Framework Convention on Climate Change - UNFCCC.

Nationally, the most significant effort to date was the submission of Bill No. 195/2011, which "establishes the national system to reduce emissions from deforestation and degradation, conservation, sustainable forest management, maintenance and increase of carbon stocks (REDD+), and other provisions", which are still in progress.

The main legislation and relevant federal and state regulations are described below, although legal compliance is not limited to only these ones. In addition, a brief analysis on international climate agreements that have been guiding the creation and development of REDD+ initiatives was conducted.

Although Brazil and the State of Rondônia do not hold an official designated authority for REDD+ projects approval, information and consent from formal and traditional authorities were obtained, along with the identification, consultation, and engagement for participation in the project design. This project consulted the surrounding populations impacted by the project, agencies and departments of the cities of Porto Velho, Candeias do Jamari, Itapuã do Oeste, and Cujubim.

International Agreements

FCCC/CP/2005/Misc.1: Reducing emissions from deforestation in developing countries: approaches to stimulate action. Submission from Parties. COP 11, Montreal, 2005.

FCCC/CP/2007/6/add.1: Report of the Conference of the Parties on its thirteenth session, held in Bali from 3 to 15 December 2007. Addendum. Part two: Action taken by the Conference of the Parties at its thirteenth session or “Action Bali Plan”. COP 13, Bali, 2007.

FCCC/CP/2009/Add.1: Report on the Conference of the Parties on its fifteenth session, held in Copenhagen from 7 to 19 December 2009. Addendum. Part Two: Action taken by the Conference of the Parties at its fifteenth session or “Copenhagen Accord”. COP 15, Copenhagen, 2009.

FCCC/CP/2010/7/Add. 1: Report of the Conference of the Parties on its sixteenth session, held in Cancun from 29 November to 10 December 2010. Addendum. Part Two: Action taken by the Conference of the Parties at its sixteenth session or “Cancun Agreement”. COP 16, Cancun, 2010.)

FCCC/CP/2011/9/Add. 1: Report of the Conference of the Parties on its seventeenth session, held in Durban from 28 November to 11 December 2011. Addendum. Part Two: Action taken by the Conference of the Parties at its seventeenth session. COP 17, Durban, 2011.

FCCC/CP/2012/8/Add.1: Report of the Conference of the Parties on its eighteenth session, held in Doha from 26 November to 8 December 2012. Addendum. Part two: Action taken by the Conference of the Parties at its eighteenth session.

FCCC/CP/2013/Add.1: Warsaw Framework for REDD-plus, held in Warsaw, Poland, from 11 to 22 November 2013, in particular the following decisions:

Decision9/CP.19: Work programme on results-based finance to progress the full implementation of the activities referred to in decision 1/CP. 16, paragraph 70. Decision10/CP.19: Coordination of support for the implementation of activities in relation to mitigation actions in the forest sector by developing countries, including institutional arrangements.

Decision12/CP.19: The timing and the frequency of presentations of the summary of information on how all the safeguards referred to in decision1/CP.16, appendix I, are being addressed and respected.

Decision13/CP.19: Guidelines and procedures for the technical assessment of submissions from Parties on proposed forest reference emission levels and/or forest reference levels.

Decision14/CP.19: Modalities for measuring, reporting and verifying.

Decision15/CP.19: Addressing the drivers of deforestation and forest degradation.

CITES, - 03/03/1973: “Convention on International Trade in endangerments Species of Wild Fauna and Flora”, signed in Washington D.C. on March 03, 1973, amended in Bonn on June 22, 1979.

International Labour Organization Convention held on 29, 1930, ratified by Brazil in 04/25/1957: It provides for the abolition of forced labor.

International Labour Organization Convention No.87, 1940: It provides for freedom of association.

International Labour Organization Convention No.97, 1949, ratified by Brazil on 06/18/1965, provides for migrant workers.

International Labour Organization Convention No.97, 1949, ratified by Brazil on 11/18/1952, provides for freedom of association and collective negotiation.

International Labour Organization Convention No. 100, 1951, ratified by Brazil on 04/25/1957: It provides for equal pay for men and women.

International Labour Organization Convention No. 105, ratified by Brazil on 6/18/1965: It provides for the abolition of forced labor.

International Labour Organization Convention No. 111, 1958, ratified by Brazil on 03/01/1965: It provides for discrimination in employment and occupation.

International Labour Organization Convention No. 131, 1970, ratified by Brazil on 5/4/1983: It provides for minimum wage establishment, especially in developing countries.

International Labour Organization Convention No. 138, 1973, ratified by Brazil on 6/28/2001: It provides for the minimum age for admission.

Convention of the International Labour Organization No.142, 1975, ratified by Brazil on 11/24/1981: It provides for the development of human resources.

International Labour Organization Convention No.143, 1975: It regulates immigrations conducted under abusive conditions and the promotion of equal opportunities for migrant workers.

International Labour Organization Convention No.155, 1981, ratified by Brazil on 5/18/1992: It provides for workers' safety and health.

International Labour Organization Convention No.169, 1989, ratified by Brazil on 7/25/2002: It provides for indigenous and tribal communities' rights.

International Labour Organization Convention No. 1825, ratified by Brazil on 2/2/2000: It provides for prohibition of the worst forms of child labor and immediate action for its elimination.

Federal Legislation and Regulations

Law 12,651 of 05/25/2012: It provides for the protection of native vegetation; amending Laws No. 6938, of August 31, 1981, Law No. 9393, of December 19, 1996, and Law No.11428 of December 22, 2006; revoking Laws No. 4771, of September 15, 1965, and No. 7754 of April 14 1989, and Provisional Measure No. 2166-67, of August 24, 2001; and other measures.

Law No. 12187 of 12/29/2009: It established the National Policy on Climate Change (PNMC) and provides other measures.

Provisional Measure No. 571, of 05/25/2012: It amends Law 12651 of May 25, 2012, which provides for protection of native vegetation; amending Laws No. 6938, of August 31, 1981, Law No. 9393,

of December 19, 1996, and Law No.11428 of December 22, 2006; revoking Laws No. 4771, of September 15, 1965, and No. 7754 of April 14 1989, and Provisional Measure No. 2166-67, of August 24, 2001.

Law No. 58,054 of 3/23/1966: It promulgates the Convention for the protection of flora, fauna and scenic beauties of the American countries. .

Decree No. 96944 of 10/12/1988: It created the Program in Defense of the Ecosystem Complex of the Legal Amazon, and other measures.

Decree No. 2661 of 7/8/1998: It regulates the sole paragraph of art. 27 of Law 4.771 of September 15, 1965 (Forest Code), by establishing precautionary standards for activities involving fire in agropastoral and forestry practices, and other measures.

Decree No. 2959 of 2/10/1999: It provides for measures to be implemented in the Legal Amazon, for monitoring, prevention, environmental education, and forest fire fighting.

Decree No. 5975 of 11/30/2006: It regulates art. 12, final part, 15, 16, 19, 20 and 21 of Law 4771 of September 15, 1965, art. 4, item III, of Law 6938 of August 31, 1981, art. 2 of Law No. 10650, of April 16, 2003, amends and adds provisions to Decrees 6514/08 and 3420/00, and other provisions.

Decree No. 7390 of 12/9/2010: Regulates articles 6, 11 and 12 of Law 12187 of December 29, 2009, establishing the National Policy on Climate Change (PNMC), and other measures.

Decree-Law No. 5452 of 05/01/1943: Approves Labor Laws Consolidation. CONAMA Resolution No. 16 of 12/07/1989: It establishes the Integrated Program for Assessment and Environmental Control of the Legal Amazon.

CONAMA Resolution No. 378 of 10/19/2006: It defines undertakings potentially responsible for national or regional environmental impact for purposes of item III, paragraph 1, art. 19 of Law 4771 of September 15, 1965, and other measures.

CONAMA Resolution No. 379 of 10/19/2006: It creates and regulates the data system and on forest management under the National Environmental System - SISNAMA.

CONAMA Administrative Rule No. 218 of 5/4/1989: It provides for felling and exploration of native forests and successors forest formations of the Atlantic Forest, and other measures.

IBAMA Administrative Rule No. 37 of 4/3/1992: Recognizes as Official List of Brazilian Endangered Flora Species the list found in the Administrative Rule.

Ministry of Environment Administrative Rule No. 103 of 4/5/2006: It provides for the implementation of the Document of Forest Origin - DOF, and other measures.

Ministry of Environment Administrative Rule No. 253 of 8/18/2006: It establishes, from 1 September 2006 on, under the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA), the Document of Forest Origin (DOF), replacing the Authorization for Transportation of Forest Products (ATPFs).

Administrative Rule 1896 of 09/12/2013: It amends Regulatory Norm No. 31. Ministry of Environment Administrative Rule No. 1 of 9/5/1996: It provides for Obligatory Reforestation and

Forest Integrated Plan.

Ministry of Environment Administrative Rule No. 07 of 4/27/1999: It provides for the authorization for deforestation in the Legal Amazon States.

Ministry of Environment Administrative Rule No. 02 of 5/10/2001: It provides for the economic exploration of forests in rural properties located in the Legal Amazon, including Legal Reserve areas and with exception of permanent preservation established in current legislation, which will be carried out through multiple use sustainable forest management practices.

IBAMA Normative Instruction No. 30 of 12/31/2002: It informs the geometric volume calculation of standing trees, applying the volume equation that specifies it, and other measures.

IBAMA Normative Instruction No. 112 of 08/21/2006: It regulates the Document of Forest Origin - DOF, established by Ordinance Ministry of Environment Administrative Rule .253 of August 18, 2006. (Amended by IBAMA Normative Instruction No. 134 of November 22, 2006)

Ministry of Environment Administrative Rule No. 06 of 12/15/2006: It provides for the reforestation and consumption of forest raw materials, and other measures.

IBAMA Normative Instruction No. 178 of 6/23/2008: It defines guidelines and procedures, provided by IBAMA, for consideration and approval on the issue of forest suppression authorizations and other forms of native vegetation in an area greater than two thousand hectares in rural properties located

in the Legal Amazon, and a thousand hectares in rural properties located in the remaining regions of the country.

Regulatory Norm No. 31 of 03/03/2005: Approves the Regulatory Norm for Safety and Health at Work in Agriculture, Cattle Raising, Forestry, Forest Exploration, and Acquafarming.

3.2 Right of use evidence (G5)

Manoa REDD+ Project activities will be developed according to the use and ownership right of Triângulo Pisos e Painéis Ltda., according to the following alternative of VCS Standard v3.2. right of use demonstration:

"4) A right of use arising by virtu of a statutory, property or contractual right on the land, vegetation or conservation or management process that generates GHG emission reduction and/or removals (...)."

The right to ownership and use are demonstrated by the following documents:

Definitive land ownership title of the 73,079 hectares in the city of Cujubim, state of Rondônia;

Updated Land Registry Certificate;

A clear land registry search certificate, covering the previous 20 years showing that the property is free of onuses and encumbrances and all transfers of title during the established period.

Clear title of property; and

Environmental Licensing in Rural Property;

An additional documentary survey concluded that that the property is under good standing status, and there are no encumbrances, liens or limiting the full use of it, also not there, there is no obstacle to carry out the Manoa REDD+ Project such as locks, liens, mortgages, foreclosures, or land disputes. The proof of this legitimacy can also be evidenced by the FSC and Cerflor certification seals obtained, which attest the legality of the project, as explained above.

In addition to the land good standing status to make Manoa REDD+ Project legally feasible, Biofílica Investimentos Ambientais made an legal agreement with Triângulo Pisos e Painéis Ltda., which owns the property, and with Douglas Antonio Granemann de Souza and Carlos Alberto Barbosa Porsh,

sustainable forest management operators, ensuring that Biofílica is the sole and exclusive developer of the project regarding the environmental services and other co-benefits.

Moreover, there are no records of disputes with third parties for the property ownership, or existing disputes over access to natural resources or property use, and Manoa Farm holds good relationship with the surrounding population,

3.3 Emission programs and other mandatory limits (CL1)

Brazil is a Kyoto Protocol Non-Annex I Parties, having no obligation to reduce greenhouse gases emissions under the UN Framework Convention on Climate Change (UNFCCC).

Furthermore, Manoa REDD+ Project has no current or historical connection with any credit generation initiative related to the Clean Development Mechanism (CDM), or other regulatory or voluntary schemes.

3.4 Participation in other GHG programs (CL1)

The Manoa REDD+ Project was not registered or seeks for registration in any other GHG program, in addition of submitting the project to validation and verification in VCS (Verified Carbon Standard) and CCBS (Climate, Community and Biodiversity Standard) standards.

VCS is mainly responsible for the certification of the benefits to the climate and carbon accounting, turning the project eligible to generate credits, and CCB ensures the generation of co-benefits for the climate, communities, and biodiversity.

3.5 Other types of environmental credits (CL1)

REDD+ Manoa Project does not hold or wishes to generate any kind of environmental credit related to GHG emissions reduction or removals claimed within the VCS Program.

3.6 Projects rejected by other GHG programs (CL1)

REDD+ Manoa project was not submitted to validation/verification upon any other GHG program and therefore has not been rejected by any other GHG program.

3.7 Respect for rights and involuntary relocation (G5)

No property rights will be affected and there will be no involuntary relocation of people or activities important to the way of life and culture of communities living nearby.

3.8 Illegal activities and project benefits (G5)

In the baseline scenario, the illegal deforestation practiced in the project area generates problems related to a scenario without the project. The project aims to prevent these illegal practices by means of a set of activities aimed at the conservation of the forest.

4 METHODOLOGY APPLICATION

4.1 Methodology title and reference

The methodology used in the project is the Methodology for Avoided Unplanned Deforestation, VM0015 version 1.1 of December 3, 2012.

4.2 Methodology application

The VCS VM0015 methodology, version 1.1 is applicable to REDD+ Manoa Project because it meets the following applicability criteria:

• Project baseline activities include unplanned deforestation as a result of agricultural activities and livestock, according to the latest version of VCS AFOLU Requirements.

• Project activities include forest protection controlled logging and selectively, in accordance with the description of the scope of "D" of the methodology used (details see page 12, Table 1 and Figure 2b document VCS VM0015)

• The project area has different types of forests, especially old growth forests that are consistent with the definition of "forest".

• The project area includes only areas classified as "forest" for a minimum of 10 years before the project start date.

Forest types found in the project area do not include rainforests in swampy areas ("forested wetlands") or common forested areas in peatlands ("peatswamp forests").

4.3 Methodology Deviations

No deviation of methodology was applied in this project.

4.4 Project boundaries

VM0015 Step 1.1 - project spatial limits

Reference Region

About one-third of Rondônia's original forest cover was deforested as a consequence of major projects such as the opening of BR-364 and the POLONOROESTE program financed by the World Bank in the 1980s. Due to the great impacts of this program in the 1990s, actions for conservation, management and protection of forest resources with resources from the Agricultural and Forestry Plan of Rondônia were proposed (PLANAFLORO). In this context (on the federal lands of Jacundá, Cajueira and Cujubim), a process of land insecurity began in the region, for even with the creation of the National Forests of Jamari (1984) and Jacundá (2004); And the settlements projects Jequitibá (2007), Agostinho Becker (1999) and Renascer (1999), currently several areas are not destineted. Thus in this region, in areas of public lands, private and not destined, the action of several agents and vectors of deforestation and forest degradation have been observed in recent years.

The reference region defined in this Project corresponds to an area of 1,009,243 hectares, about 14 times the size of the Project Area, located in the federal states of Jacundá, Cajueira and Cujubim, with a deforestation rate of 7,374 hectares per year (0.79% per year) during the period from 2000 to 2012. This reference region considers mainly in its spatial limits to determine the baseline of the Project the context of the land dynamics of Manoa farm and its typical deforestation dynamics of the arc of deforestation in the Brazilian Amazon: areas with forest exploitation, forest degradation after the removal of timber with commercial value, followed by deforestation for land tenure and pasture creation. In addition to this context, the following criteria established on pages 18 and 19 of document VM0015, listed below, were analyzed.

- **Agents and causes of deforestation**: Group 1 - illegal loggers and invasors; Group 2 - Rural property holder with forest; Group 3 - "landless" groups, squatters and small farmers; Group 4 - farmers and rural producers of medium and large size.
- **Infrastructure Drivers:** No type of infrastructure such as highways, hydroelectric, bridges, are expected to be deployed in the region of reference. Areas of planned deforestation within the Project Area were excluded.

- **Landscape configuration and ecological conditions:** 100% of the Project area have the same vegetation classes found throughout the reference region; 100% of the Project area is within the range of elevation of the reference region; 100% of the slope of the Project area is within the slope variation of the reference region; The project area has an annual average rainfall of 2300 mm, within the same rainfall range of more than 90% of the reference Table 10 region. presents the values of the criteria used to define the spatial limits of the reference region.
- **Socioeconomic and cultural conditions:** The legal status of the land within the project area in the baseline scenario can be observed in several locations in the reference region and the landed status of the Project area (private property) occurs in 43% of the reference region. The current and projected types of land use and land cover types in the project area are the same over the entire reference region. The Project area is governed by the same laws and regulations applied throughout the region of reference.

Table 10 Spatial attributes of landscape configuration and ecological conditions in RR and AP.

Class of Vegetation	Reference Region	Project Area
Floresta Ombrófila Aberta Aluvial com palmeiras	Yes	No
Floresta Ombrófila Aberta Submontana com cipós	Yes	Yes
Floresta Ombrófila Aberta Submontana com palmeiras	Yes	Yes
Floresta Ombrófila Aberta Terras Baixas com palmeiras	Yes	Yes
Floresta Ombrófila Densa Aluvial Dossel emergente	Yes	No
Floresta Ombrófila Densa Aluvial Dossel uniforme	Yes	Yes
Floresta Ombrófila Densa Submontana Dossel emergente	Yes	No
Formações Pioneiras	Yes	No
Elevation Range (meters)	19-276	57-220
Average Slope (%)	5.32	6.21
Annual Average Rainfall	2300	2300

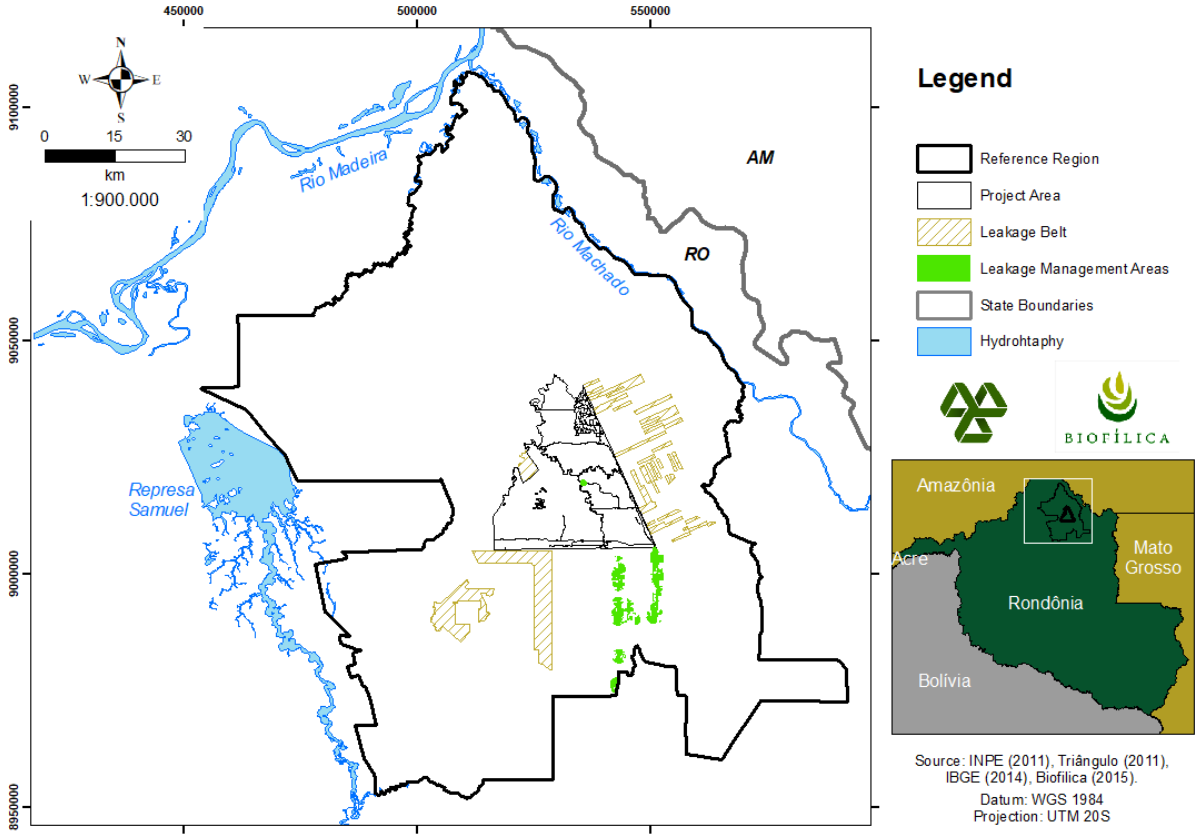


Figure 12 Location of Reference Region, Project Area, and Leakage Belt.

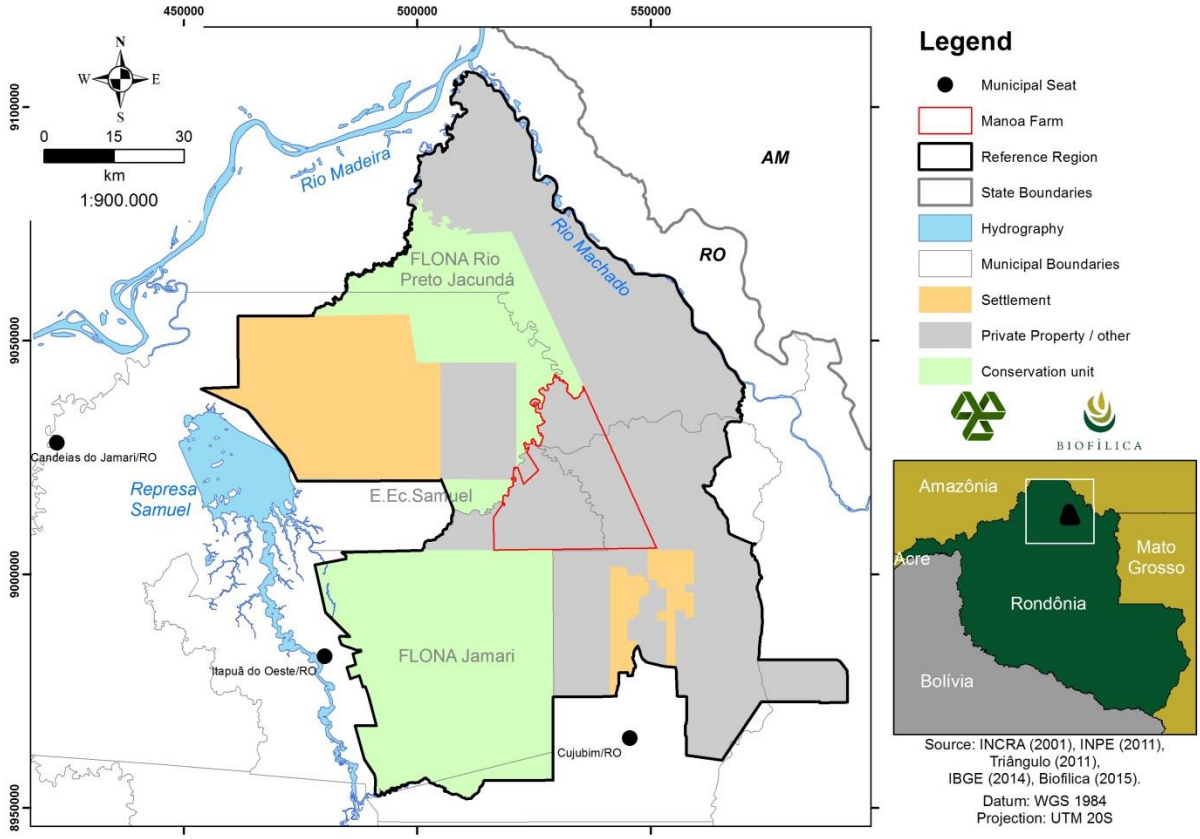


Figure 13 Land situation in the Reference Region.

Project Area

The REDD+ Project has an area of 72,843 hectares of forest under the control of Triângulo Pisos and Panels, and where the proposed conservation activities will be carried out. The boundaries of the project area were defined considering the area of existing forest within the limits of the Manoa Farm in the project start year. Planned areas for implementation of the project infrastructure were excluded. The spatial boundaries of the project area are based on the coordinates of the vertices of the property, as coordinates of the AV-15, of April 28, 2015, of the Certificate of Integral Registration number 15.418 (Figure 14). Table 11 shows the coordinates used to delimit the physical boundaries of the Project Area

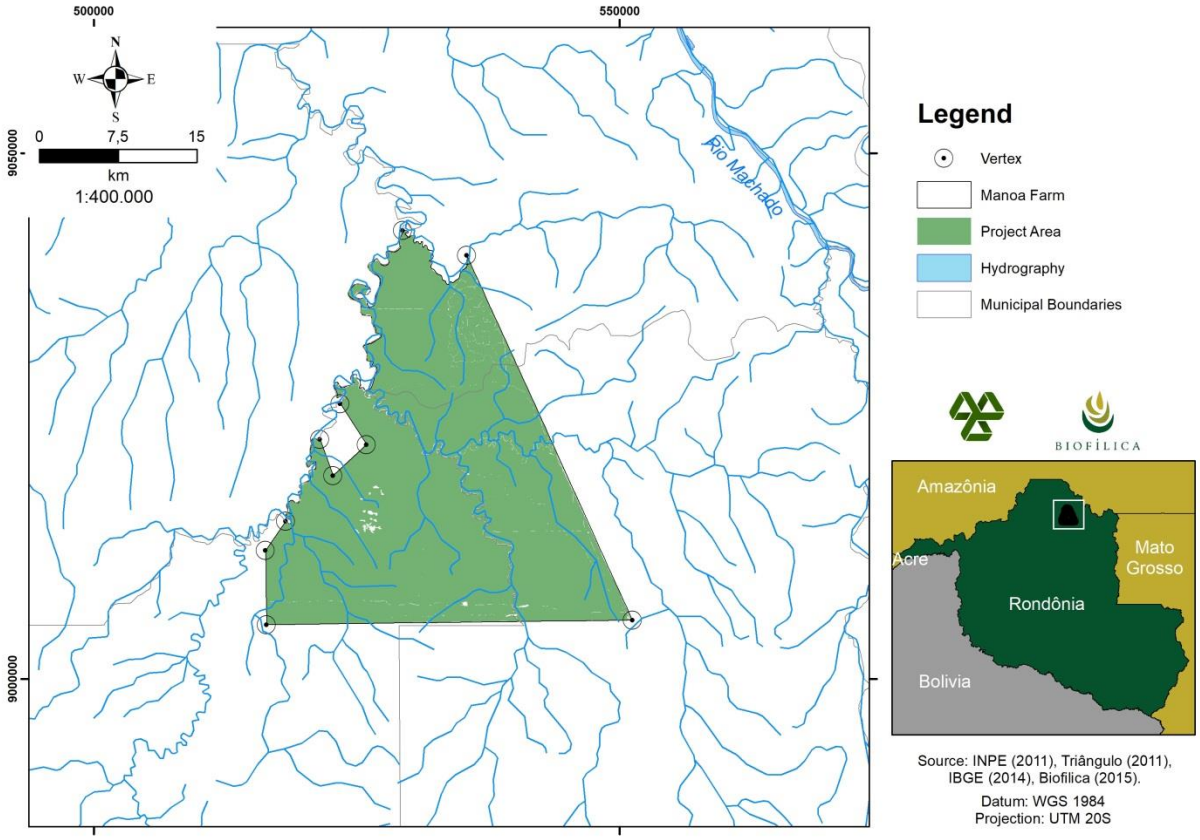


Figure 14 Physical limits of the Project Area.

Table 11 Project Area vertices and coordinates UTM WGS94 - Zone 20S

Vertex	Coordinate X	Coordinate Y
V 01	551238,33	9005594,82
V 02	516440,07	9005173,13
V 03	516334,28	9012228,58
V 04	518254,07	9015021,68
V 05	521512,60	9022815,51
V 06	522755,30	9019339,72
V 07	525950,75	9022297,99
V 08	523451,21	9026196,65
V 09	529409,79	9042655,91
V 10	535470,92	9040284,04

Leakage Belt

The leakage belt was defined using the mobility approach (option II available in VCS Methodology VM0015). This option was selected because there are no data or studies in the Reference Region that prove that "economic gains" is a vector that represents more than 80% of deforestation observed in the historical reference period. Analyzes carried out with data from the Terraclass Project (INPE and EMBRAPA, 2012) have demonstrated that more than 40% of the deforested area in the Reference Region is not converted to productive uses, remaining as capoeiras or secondary vegetation. According to the socioeconomic study carried out in this project, deforestation is the result of a chain of actions related mainly to land insecurity and lack of command and control actions of state and municipal institutions (Ecoporé, 2015).

In this way a multicriteria analysis was performed to define the spatial limit of the Leakage Belt. For this definition, restriction and facilitation criteria related to the mobility potential of deforestation agents were considered. Therefore, the limit of the Leakage Belt was composed of private areas around the Manoa farm, and a public area to the south.

It was defined as a restriction criterion for these areas, governance characteristics similar to Manoa farm, that is, private areas with total or partially controlled access, with forest cover, where the forest exploitation occur or has already occurred. Therefore, public areas under concession for forest management in the Jamari National Forest, to the south, private areas to the east where forest exploitation were is carry out, and a private area to the west that was recently acquired by Grupo Triângulo.

Regarding the criteria of mobility facilitate, besides the knowledge of the proponents in relation to the local context, the risk map of deforestation generated by the project, which used different input variables in its construction, such as: distance of roads, distance of old deforestation, land category, characteristics of terrain, among others (Table 23). The influence of these variables on the explanation of deforestation in the Reference Region was determined by the Weight of Evidence for each variable generated by Dinamica Ego, as described in Step 3, "Variables to explain the location of deforestation". As result, the variables that showed the highest weight, that is, higher influence on mobility facilitate for the deforestation agents were, roads, old deforestation and private areas (Figure 20). Figure 15 clearly shows that the proximity of roads and old deforestation directly influences the determination of risk areas.

In this way, were included in the Leakage Belt boundary, private areas east of Manoa Farm and Forest Management Units (UPAs) in the Jamari National Forest with greater risk of deforestation according to the transition potential determined by the input variables in the deforestation model. A private area west of Fazenda Manoa was also considered, even without the indication of risk by the deforestation model, because it is under the control of the Grupo Triângulo, but not included in the management plan and does not present the same level of surveillance and physical presence as in Manoa farm. Therefore, according to the aspects considered, the limit of the casting belt was defined as shown in figure 15 below.

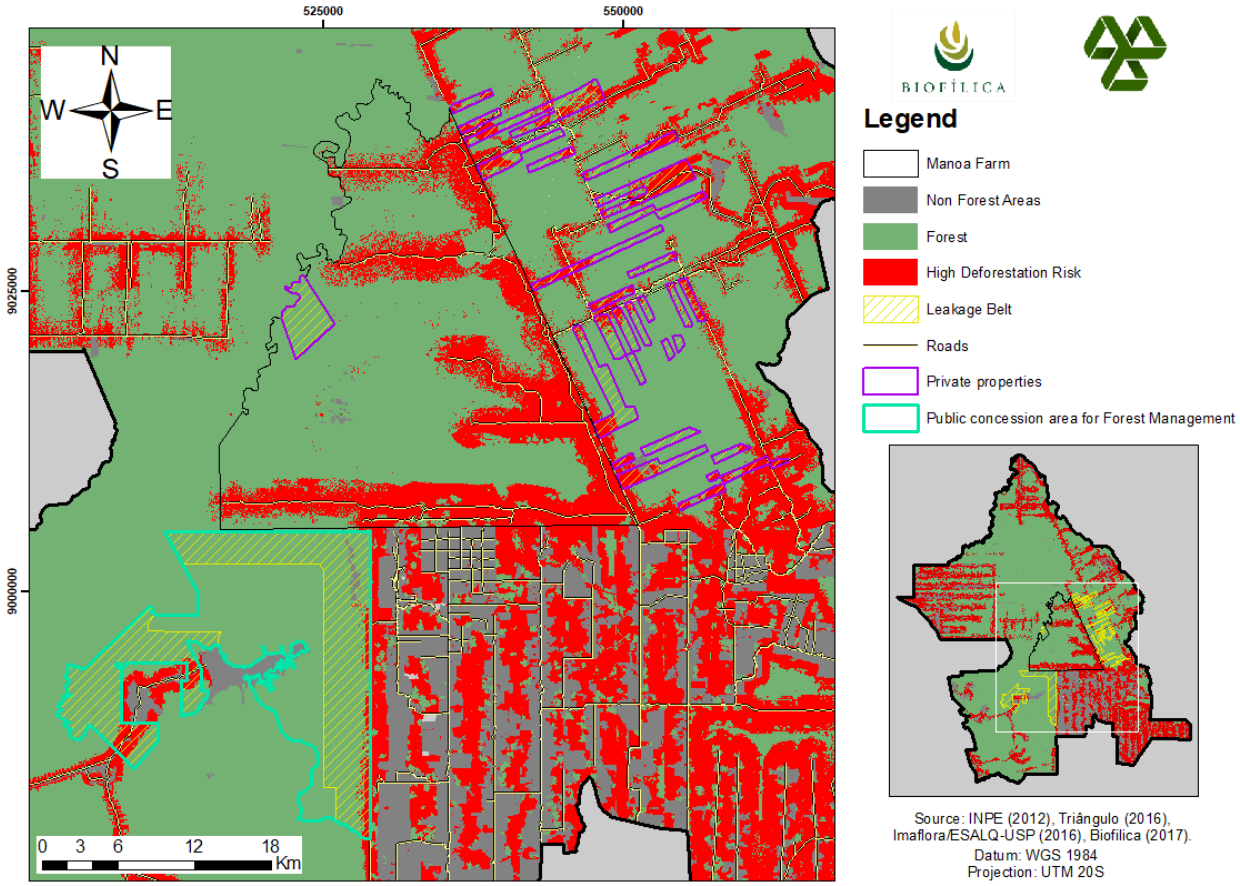


Figure 15 Mobility Analisys for Leakage Belt definition

Leakage Management Areas

The areas in which the project intends to exert the influence of its activities to reduce the risks of deforestation south of the Manoa Farm. The main criteria for the selection of these areas were: areas deforested until the year 2012 inserted in a hypothetical zone of influence of 1.5 kilometers around the points of interviews carried out by the socioeconomic study (Figure 35) that composes settlements of small rural producers lacking technical assistance. The CEFLOM area was also included in the Leakage Management areas as it is not part of the Project Area and represents the place where most of the events carried out by the project will take place. Section 2 describes the activities to be developed by the REDD+ project in the leakage management areas, involving the implementation of training, training and lectures focused on sustainable socioeconomic development, and actions aimed at the development of small local producers associations.

Forest

The definition of "forest" used by the Project is in accordance with Resolution No. 2 of the Interministerial Commission on Global Climate Change (CIMGC[1]). Data from the Deforestation Monitoring System in the Amazon (PRODES[2]), prepared by the National Institute for Space Research (INPE), were used to produce the Forest Area Reference Map (VM0015 Step 1.1.5), introduced in Figure 16. The smallest mapping unit (MMU) of the PRODES Digital system is 1 hectare (GOFC-GOLD, 2011).

[1] Definition of forest by the Designated National Authority: minimum area of 1 hectare with 30% of surface covered by trees with the potential to reach a minimum height of 5 meters.

[2] www.obt.inpe.br/prodes

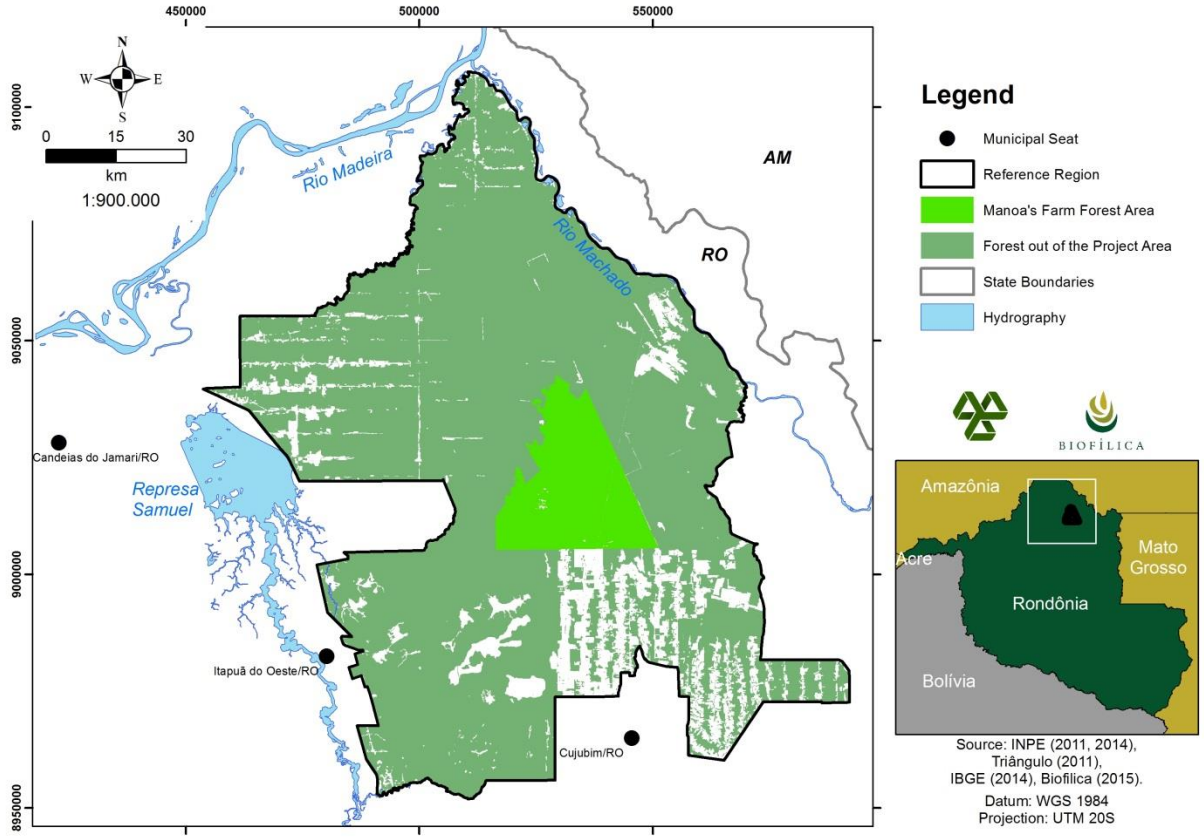


Figure 16 Reference map of forest area in the Reference Region.

VM0015 Step 1.2 - Time Limits

- **Start date of conservation activities:** December 01, 2013
- **Starting date of LULCC historical reference period:** 2000
- **Start and end date of the first baseline fixed period:** fixed baseline period is 10 years after the start of project activities, with reevaluation up to 31/12/2023.
- **Monitoring period:** the monitoring period is one year, with activities started in 2013.

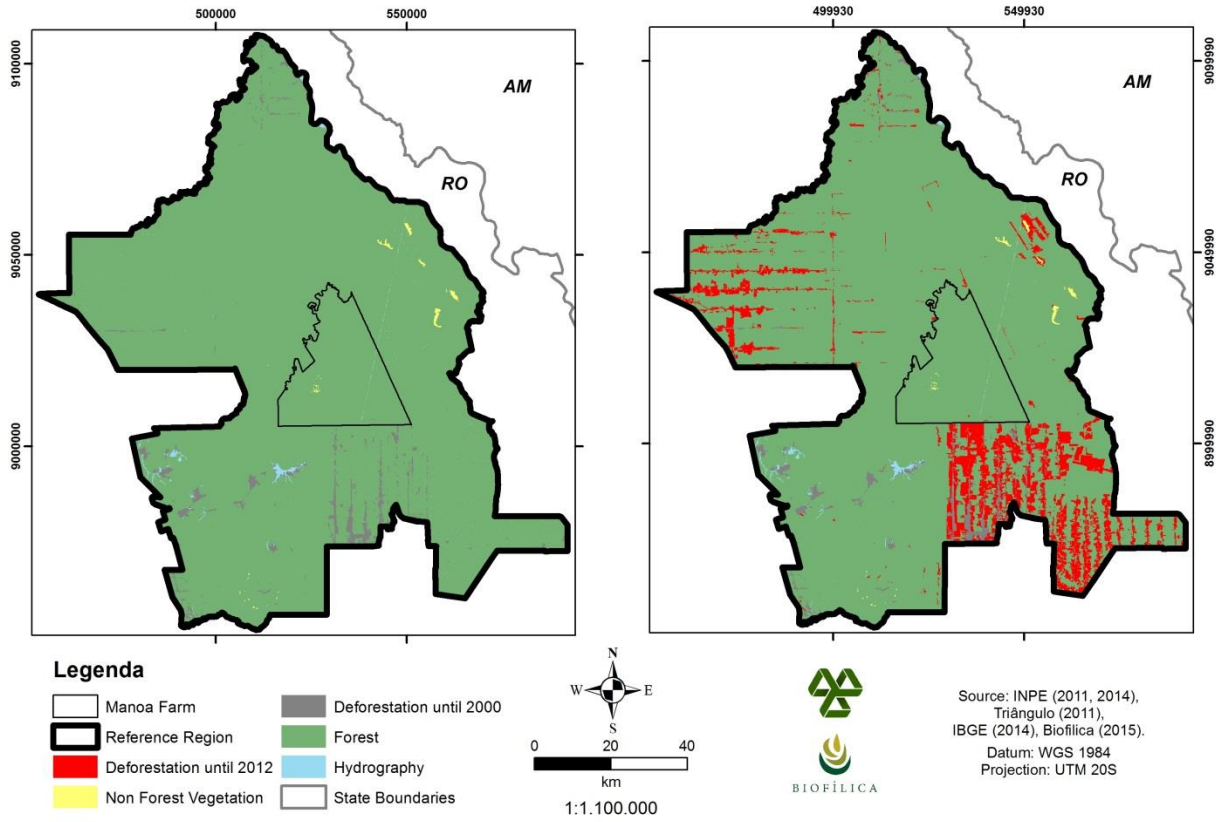


Figure 17 Land use and land cover change map from 2000 to 2012.

VM0015 Step 1.3 - Carbon reservoirs

The carbon reservoirs considered in the project are found in Table 12.

Table 12 Carbon reservoirs included in the REDD+ Manoa project (Table 3 of VM0015 methodology).

Carbon Reservoirs	Included/Excluded	Justification/Explanation of Choice
Above ground	Tree: Included	Change in carbon stocks in this reservoir is always significant
	No Tree: Excluded	It should be included in categories in which the final class of land cover is perennial. Reservoir was not inventoried to compose the final forest carbon stock of the project area.
Below Ground	Included	Reservoir represents 15% of the expected emissions in the baseline scenario
Dead wood	Excluded	The changes in carbon stocks for this reservoir are considered insignificant in relation to total emissions and will not be included.
Wood products	Excluded	Not included, the reservoir of wood products in the baseline scenario is lower than in the scenario with the project.
Litter	Excluded	It should not be inventoried according to VCS program updade on May 24, 2010.
Organic carbon in soil	Excluded	Recommended when forests are converted to agricultural crops. Should not inventoried in conversion to pasture and perennial crops according to VCS Program updates on May 24, 2010. Not applicable to the project.

GHG sources and sinks in the baseline scenario are shown in Table 13 .

Table 13 GHG sources included or excluded within the limits of the project activities (VM0015 Methodology Table 4).

Source:	Gas	Included/Excluded	Justification/Explanation of Choices
Biomass Burning	CO_2	Excluded	Registered as changes in carbon stocks
	CH_4	Excluded	Considered insignificant, according to VCS Program updates, on May 24, 2010.
	N_2O	Excluded	Considered insignificant, according to VCS Program updates, on May 24, 2010.
Cattle emissions	CO_2	Excluded	Not a significant source
	CH_4	Excluded	The project does not include livestock activities, so it is conservative to exclude such emissions once they are present in the baseline scenario.
	N_2O	Excluded	The project does not include livestock activities, so it is conservative to exclude such emissions once they are present in the baseline scenario.

4.5 Baseline Scenario (G2)

VM0015 Step 2- Background Analysis of Soil Use and Cover

Collection from proper data source

Data from software Digital PRODES were used for mapping land use and cover classes, available in vector format (shapefile). A total of 48 satellite images were used to map the classes Forest, Disturbed Vegetation (Deforestation), Hydrography, and Nonforest Vegetation. The images cover the historical reference period (2000 to 2012) and correspond to the following orbits/points of Landsat satellite: 231/66, 231/67, 232/65, 232/66 and 232/67 (Table). The assessment of the PRODES classification was performed using 14 high resolution images of the RapidEye satellite corresponding to the following scenes: 2035215; 2035116; 2034815; 2035015; 2034915; 2035016; 2034916; 2034816; 2035117; 2035017; 2034918; 2034917; 2034818; 2034817.

Table 14 Satellite images used to map the soil area in the reference region (VM0015 methodology Table 5)

Vector (Satellite or airplane)	Sensor	Resolution		Coverage	Acquisition date	Scene identifier	
		Spatial (m)	Spectral	(km^2)	(DD/MM/YY)	Path/ Latitude	Row/ Longitude
Landsat	TM	30	0.45 – 2.35 µm	34.225	11/08/2001	231	66
Landsat	TM	30	0.45 – 2.35 µm	34.225	11/06/2002	231	66
Landsat	TM	30	0.45 – 2.35 µm	34.225	24/07/2003	231	66
Landsat	TM	30	0.45 – 2.35 µm	34.225	26/07/2004	231	66
Landsat	TM	30	0.45 – 2.35 µm	34.225	01/10/2005	231	66
Landsat	TM	30	0.45 – 2.35 µm	34.225	02/09/2006	231	66
Landsat	TM	30	0.45 – 2.35 µm	34.225	04/08/2007	231	66
Landsat	TM	30	0.45 – 2.35 µm	34.225	06/08/2008	231	66
Landsat	TM	30	0.45 – 2.35 µm	34.225	09/08/2009	231	66
Landsat	TM	30	0.45 – 2.35 µm	34.225	27/07/2010	231	66
Landsat	TM	30	0.45 – 2.35 µm	34.225	12/06/2011	231	66
Landsat	TM	30	0.45 – 2.35 µm	34.225	08/08/2012	231	66
Landsat	TM	30	0.45 – 2.35 µm	34.225	19/08/2001	231	67
Landsat	TM	30	0.45 – 2.35 µm	34.225	11/06/2002	231	67
Landsat	TM	30	0.45 – 2.35 µm	34.225	09/08/2003	231	67
Landsat	TM	30	0.45 – 2.35 µm	34.225	26/07/2004	231	67

Landsat	TM	30	0.45 – 2.35 µm	34.225	14/08/2005	231	67
Landsat	TM	30	0.45 – 2.35 µm	34.225	16/07/2006	231	67
Landsat	TM	30	0.45 – 2.35 µm	34.225	04/08/2007	231	67
Landsat	TM	30	0.45 – 2.35 µm	34.225	06/08/2008	231	67
Landsat	TM	30	0.45 2.35 µm	34.225	09/08/2009	231	67
Landsat	TM	30	0.45 – 2.35 µm	34.225	27/07/2010	231	67
Landsat	TM	30	0.45 – 2.35 µm	34.225	12/06/2011	231	67
Landsat	TM	30	0.45 – 2.35 µm	34.225	08/08/2012	231	67
Landsat	TM	30	0.45 – 2.35 µm	34.225	10/08/2001	232	66
Landsat	TM	30	0.45 – 2.35 µm	34.225	18/06/2002	232	66
Landsat	TM	30	0.45 – 2.35 µm	34.225	15/07/2003	232	66
Landsat	TM	30	0.45 – 2.35 µm	34.225	15/06/2004	232	66
Landsat	TM	30	0.45 – 2.35 µm	34.225	09/06/2005	232	66
Landsat	TM	30	0.45 – 2.35 µm	34.225	08/08/2006	232	66
Landsat	TM	30	0.45 – 2.35 µm	34.225	11/08/2007	232	66
Landsat	TM	30	0.45 – 2.35 µm	34.225	28/07/2008	232	66
Landsat	TM	30	0.45 – 2.35 µm	34.225	31/07/2009	232	66
Landsat	TM	30	0.45 – 2.35 µm	34.225	19/08/2010	232	66
Landsat	TM	30	0.45 – 2.35 µm	34.225	06/08/2011	232	66
Landsat	TM	30	0.45 – 2.35 µm	34.225	05/08/2012	232	66
Landsat	TM	30	0.45 – 2.35 µm	34.225	10/08/2001	232	67
Landsat	TM	30	0.45 – 2.35 µm	34.225	06/09/2002	232	67
Landsat	TM	30	0.45 – 2.35 µm	34.225	31/07/2003	232	67
Landsat	TM	30	0.45 – 2.35 µm	34.225	02/08/2004	232	67
Landsat	TM	30	0.45 – 2.35 µm	34.225	21/08/2005	232	67
Landsat	TM	30	0.45 – 2.35 µm	34.225	23/07/2006	232	67
Landsat	TM	30	0.45 – 2.35 µm	34.225	27/08/2007	232	67
Landsat	TM	30	0.45 – 2.35 µm	34.225	28/07/2008	232	67
Landsat	TM	30	0.45 – 2.35 µm	34.225	31/07/2009	232	67
Landsat	TM	30	0.45 – 2.35 µm	34.225	19/08/2010	232	67
Landsat	TM	30	0.45 – 2.35 µm	34.225	06/08/2011	232	67
Landsat	TM	30	0.45 – 2.35 µm	34.225	05/08/2012	232	67
RapidEye	Multiespectral	5	0,44 - 0,85 µm	560	23/08/2011	2035215	
RapidEye	Multiespectral	5	0,44 - 0,85 µm	560	31/05/2011	2035116	
RapidEye	Multiespectral	5	0,44 - 0,85 µm	560	31/05/2011	2034815	

RapidEye	Multiespectral	5	0,44 - 0,85 µm	560	31/05/2011	2035015
RapidEye	Multiespectral	5	0,44 - 0,85 µm	560	31/05/2011	2034915
RapidEye	Multiespectral	5	0,44 - 0,85 µm	560	31/05/2011	2035016
RapidEye	Multiespectral	5	0,44 - 0,85 µm	560	31/05/2011	2034916
RapidEye	Multiespectral	5	0,44 - 0,85 µm	560	14/08/2011	2034816
RapidEye	Multiespectral	5	0,44 - 0,85 µm	560	05/08/2011	2035117
RapidEye	Multiespectral	5	0,44 - 0,85 µm	560	14/08/2011	2035017
RapidEye	Multiespectral	5	0,44 - 0,85 µm	560	14/08/2011	2034918
RapidEye	Multiespectral	5	0,44 - 0,85 µm	560	14/08/2011	2034917
RapidEye	Multiespectral	5	0,44 - 0,85 µm	560	14/06/2013	2034818
RapidEye	Multiespectral	5	0,44 - 0,85 µm	560	14/08/2011	2034817

Definition of land use and cover classes

The land use and cover classes used in this project are shown in Table 15. As demonstrated in step 6 of this document, the analysis of variance among the forest typologies in the Project Area did not present a statistically significant difference. Therefore, only one forest class was considered for this project. The description of each class and the existing area before the Project start year are shown below:

Table 15 Land use and Land cover classes existing in the Reference Region (VM0015 Table 6).

Class Identification		Carbon Stock Trend	Present in[1]	Base Line Activity[2]			Description
IDcl	Name			LG	FW	CP	
1	Disturbed vegetation in Balance	Constant	RR, LM.	Yes	Yes	No	Deforested areas due to clearcutting and with vegetation type different from Ombrophylous Forest.
2	Forest	Constant	RR,PA, LK	Yes	Yes	Yes	Remaining forest
3	Hydrography	Constant	RR	No	No	No	Water bodies
4	Non-forest Vegetation	Constant	RR	No	No	No	Nonforest vegetation natural coverage

[1] - RR: Reference Region; PA: Project Area; LK Leakage Belt; LM Leakage Management Areas

[2] - LG: Logging. FW = Fuel-wood collection; CP = Charcoal Production (yes/no)

- **Disturbed Vegetation in Balance** (107.988 ha): deforested Ombrophylous Forest areas converted to other land uses (mosaic of different types of vegetation including pastures, clearings, crops, and secondary vegetation).
- **Forest** (895.214 ha): remaining forest area belonging to different Ombrophylous Forest vegetation types.
- **Nonforest Vegetation No.** (1.587 ha): areas consisted of natural vegetation with different forest physiognomy, including Woody Savannah (Cerrado), Grassy-Woody Savannah (Campo Limpo de Cerrado), Campinarana, among others.
- **Hydrography** (3.965 ha): water bodies (rivers, lakes, streams, etc.).

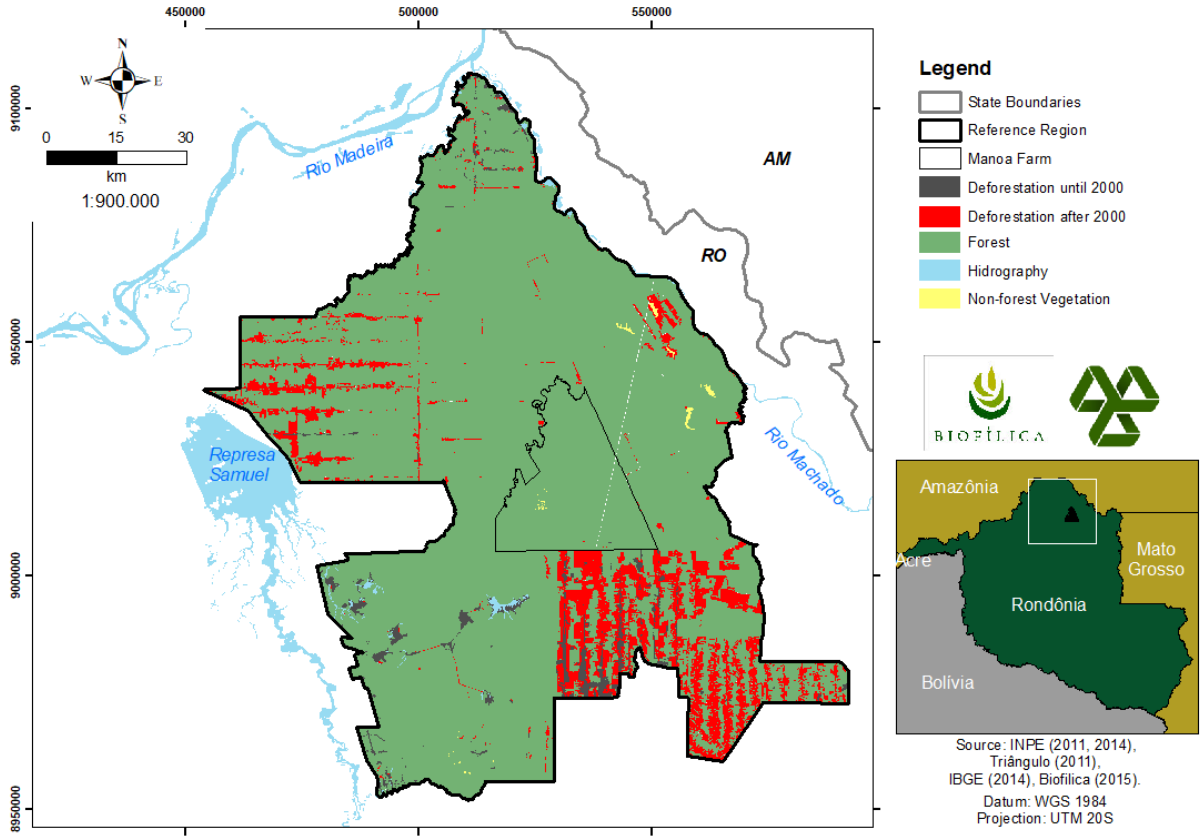


Figure 18 Land Use and Land Cover map and deforestation for the sub-period analyzed.

Definition of land use and cover change categories

The project holds two categories of use and change of land use that are expected to take place within the project area and of the leakage belt: change of areas with forest to areas with anthropic vegetation in balance.

Table 16 Definition of land use and land use change categories (VM0015 methodology Table 7.b).

ID_{cl}	Name	Carbon Stock Trend	Present in	Activity in the Baseline case			Name	Carbon Stock Trend	Present in	Activity in the project case		
				LLG	FFW	CCP				LLG	FFW	CCP
I1/F1	Forest	Constant	PA	No	No	No	Anthropic Vegetation	Constant	RR. LM	No	No	No
I1/F1	Forest	Constant	LK	Yes	Yes	No	Anthropic Vegetation	Constant	RR. LM	No	No	No

Analysis on the land use and land use change history (VM0015 Step 2.4)

Deforestation mapping data provided by PRODES were used to analyze the history of land use changes. The main methodological steps conducted by PRODES to map deforestation in the Brazilian Amazon are as follows:

- **Preprocessing:** according to Câmara et al. (2006) the main images preprocessing procedures carried out by PRODES consist of selection images with less cloud incidence, with the acquisition date closest to the dry season in the Amazon, and with proper radiometric quality; georeferencing of the images with a spatial resolution of 30 meters with topographic maps at 1: 100,000, and NASA orthorectified images in MrSID format.
- **Interpretation and classification:** the satellite images classification method used by PRODES follows four main steps. First it generates a spectral mixture model identifying t the vegetation components, soil, and shade in the images. This technique is known as spectral linear mixture models (SLMM), which attempts to estimate the percentage of vegetation, soil, and shade components for each cell (pixel) of the image. The second step is the application of the segmentation technique, which identifies, in the satellite image, spatially adjacent regions (segments) with similar spectral characteristics. After segmentation, the classification of segments take places individually, to identify the forest, nonforest vegetation, hydrography, and deforestation (anthropic vegetation) classes Finally, the result of the classified segmentation is subjected to the editing process, or classification audit, performed by a specialist, ending with the creation of the state mosaics.

- **Post-processing:** The data generated in the classification of INPE / PRODES were used integrally for the post-processing stage. For the analyzes we used the mapping performed for the year 2012, so that the data includes the historical changes in land use since 2000 as described in the data collection stage. All analyzes were carried out using Geographic Information Systems (GIS), and the results of the classification as well as the subsequent analyzes conducted by the project were submitted to the audit process. The results of the post-processing step were shown in Figure 16, Figure 17, Figure 18 and Table 18.

Map accuracy assessment

The mapping check conducted by PRODES was carried out by comparing each class of the most recent land use and coverage map class (2012), with a set of 93 points randomly distributed on the reference region. The reference data used for this step came from visual interpretation of high spatial resolution images from RapidEye satellites. Using the reference points and the 2012 land use and land cover map, it was possible to check the mapping performance through the analysis of the confusion matrix (Table 3), according to Congalton (1999). The overall accuracy of the mapping for the different classes of land use and cover showed values greater than 90%. The overall accuracy of the forest cover reference map was of 93%.

Table 17 Confusion Matrix of PRODES 2012 data evaluation.

CLASSIFIED	REFERENCE						
		Forest	Deforestation	Water	Non Forest	Total	User Accuracy
	Forest	41	2	0	1	44	93%
	Deforestation	2	26	0	0	28	93%
	Water	1	0	9	0	10	90%
	Non Forest	0	0	0	11	11	100%
	Total	44	28	9	12	93	
	Producer Accuracy	93%	93%	100%	92%		

Analysis Results from the Use and Changes History in Land Use

The results of the analysis of the history of deforestation that occurred between 2000 and 2012 in the reference region are presented in Table 18 and Table 18. A deforested area between 2000 and 2012 of approximately 107,988 hectares (about 9% of the forest Year 2000).

Table 18 LULC Change Matrix in the reference region between 2000 and 2012 (VM0015 Table 7).

ID_{cl}		Name	Initial LU/LC Class (2000)				Total (ha)
			Anthropic vegetation	Forest	Hydrography	Non-forest vegetation	
			I1	I2	I3	I4	
Final LU/LC class (2012)	F1	Anthropic vegetation	19.503	88.485			**107.988**
	F2	Forest		895.214			**895.214**
	F3	Hydrography			3.965		**3.965**
	F4	Non-forest vegetation				1.587	**1.587**
Total (ha)			**19.503**	**983.699**	**3.965**	**1.587**	**1.008.754**

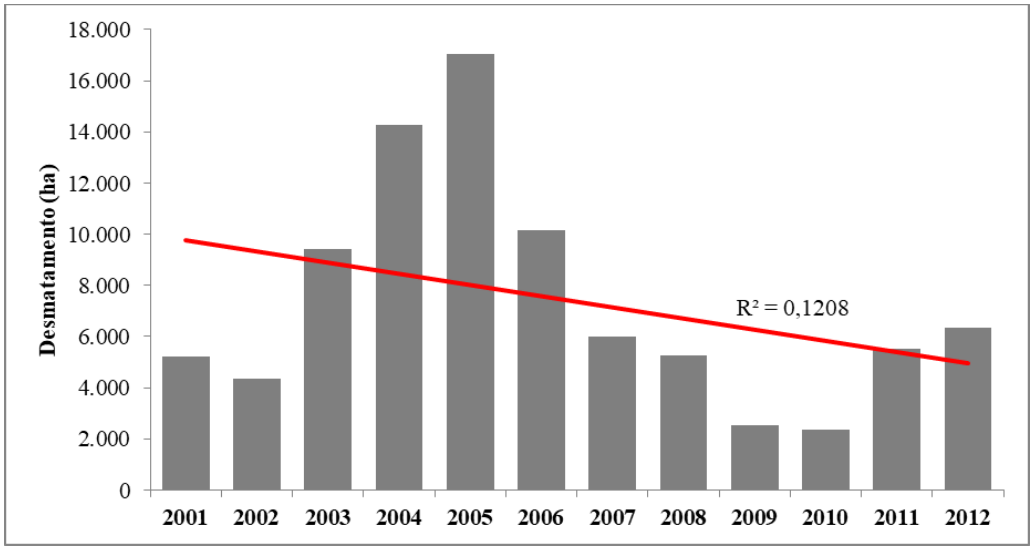


Figure 19 Annual deforestation in the Reference Region between 2000 and 2012.

Preparation of the Methodology Attached to PD

Methodological procedures for the acquisition, preprocessing, classification, post-classification, and evaluation on the accuracy of remote sensing images for analysis of changes in land use and land cover during the Project duration.

The official monitoring of the Brazilian Amazon conducted annually by PRODES was used for the development of the baseline and will be used to monitor the project area and leakage belt. In case PRODES data are unavailable or new sensors with better resolution are available, the following procedures will be used to maintain the consistency of the monitoring with the use of remote sensing:

a) **Data Acquisition:** satellite images from optical or radar sensors (when necessary) should be used. Optical images should have a spectral resolution between 0:45 and 2:35 µm. Radar images should be acquired in band X (cm 3) C (5 cm) or L (23 cm). For the mapping of forest cover and land use, Landsat images with a resolution of 30 meters will be used, images of higher spatial resolution will be used as support when necessary. The images acquisition period should be during lower incidence of clouds and rainfall in the region, between the months of August and November. Concerning forest cover monitoring in the Project area and Leakage Belt, the satellite image should cover the area corresponding to the following geographical coordinates: 62°58'29,993"W - 9°8'18,737"S e 62°9'29,934"W - 9°15'25,649"S.

b) **Preprocessing:** the images should be geometrically corrected through georeferencing in ArcGIS 10 or equivalent software, using topographic maps as reference in the scale 1:100,000 or USG-NASA orthorectified images in MrSID format. The georeferencing RMS should be lower than 1 pixel for optical images and approximately 1.5 piexel for radar image. All data should be in the UTM coordinate system, Zone 20S and Datum WGS 1984.

c) **Classification:** use the optical images to transform the digital numbers value in scene components (vegetation, soil, and shade) through the spectral mixture algorithm. Select images of the soil and shade component and apply the segmentation technique through the regions increasing algorithm, with threshold parameters of similarity equal to 8 and area threshold equal to 4. The classification is performed using ISOSEG unsupervised algorithm with 90% acceptance threshold for classes: forest, new deforestation, nonforest vegetation, hydrography, and clouds. These segmentation and classification algorithms may be applied using the image processing software such as SPRING 5 and TerraView 4. The mapped change of category is from forest class to deforestation class.

d) **Post-classification:** the classification result in *raster* format will be transformed in vector format for classification audit in ArcGIS 10. For analysis of areas with cloud cover will be performed the visual interpretation with alternative images at different dates within the same period or radar images, when necessary will be realized through the field truth.

e) **Evaluation of classification accuracy:** performed by analyzing the overall accuracy and kappa index obtained from a confusion matrix (CONGALTON, 1999). At least 90 points randomly distributed derived from high spatial resolution satellite imagery (≤5 meters). The minimum accuracy of the classification mapping should be 80% for individual classes and 90% for overall accuracy.

VM0015 Step 3 - Agents Analysis, Drivers, and Underlying Causes of Deforestation and its Future Development

Identification of forestation agents:

Based on field interviews[3], consultation with Ecoporé researchers and representatives of local institutions, the following groups of deforestation agents were identified:

a) **Deforestation agents in the reference region**: **Group 1** - illegal loggers and invasors; **Group 2** - Rural property holder with forest; **Group 3** - "landless[4]" groups, squatters and small ranchers; **Group 4** - farmers and rural producers of medium and large size.

b) **Relative importance of the historical deforestation amount allocated to each agent or group**: These deforestation groups are responsible for 100% of the unplanned deforestation observed in the Reference Region (Table 19).

c) **Brief description**: **Group 1** - Illegal loggers and invasors are motivated by the supply of wood in areas of easy access and low incidence of inspection. This group acts through the illegal extraction of wood that is "heated" in the sawmills present in the municipality of Cujubim and other itinerants in the region (moving according to the supply of wood). The deforestation caused by this group occurs in the form of opening of roads, branches, forest loaders and wood yards and forest degradation. **Group 2** is comprised of rural property owners who own native forest areas on their property, this group usually performs deforestation in search of an increase in the productive area and valorization of its properties, where the forest is not the main source of income for the owner. The agents of **Group 3** ("landless", squatters and small ranchers) carry out illegal subdivision in areas not designated or irregularly owned, and in some cases legal when promoted by INCRA. It was possible to observe reports that such agents promote the invasion of private areas when fragility and low surveillance are identified. **Group 3** agents may act jointly or independently of **Group 1** agents, since **Group 3** agents aim to carry out deforestation to install plots and small areas with livestock pasture, in order to take possession of the area. There are numerous cases of invasion in private areas and

[3] Data collected between October 8 to 17, 2014 for the Socioeconomic Diagnosis carried out by Ecoporé (2014)

[4] Migrants who often invade isolated forest areas, which are not identified with the National Movement of Landless Workers (MST).

Conservation Units, where "social groups" (locally called guerrillas) act together with illegal loggers to steal wood and take possession of these areas after deforestation. There are reports of situations where squatters and small farmers buy lots of land through "drawer contracts", without consulting the land tenure situation in the notaries, INCRA or SEDAM. The agents of **Group 4** are composed of local farmers and rural producers of medium and large purchasing power. These agents cause deforestation by opening irregular access infrastructure (roads, airstrip), extensive grazing for livestock, legal and illegal logging, and annual crop cultivation. Over time, these agents perform land concentration in the region through the acquisition of properties of squatters and small farmers. The activities of the Group 4 agents promote the incentive and the displacement of the agents of **Groups 1, 2 and 3** to new areas of expansion, boosting the chain of events that leads to deforestation.

The study "Timber Activity in the Brazilian Amazon", produced by IMAZON in partnership with the Ministry of the Environment (IMAZON, 2009)[5], pointed out the existence of a lumber pole with 38 logging companies in the region, which at that time explored 311,000 cubic meters. Ecoporé (2015) verified the existence of 72 loggers in the locality, data from IBGE indicate about 354 thousand cubic meters of wood harvested in 2013. That is, each logging industry in the municipality of Cujubim processed an average of 4,916 cubic meters of wood only in the year 2013. The Manoa farm contributes less than 10% of the total processed in the municipality. Thus, excluding the volume provided by Fazenda Manoa and considering the potential lumber of the remaining forests, there is strong evidence that the raw material that supplies Cujubim loggers is of illegal origin. As this action is the initial cause of the deforestation process, the action of deforestation agents point to a continuation of the deforestation process.

d) **Brief assessment of the most likely development of the population size of the identified main agent groups in the Reference Region, Project Area and Leakage Belt:** The context highlighted in the Reference Region, which should follow the same trend in the Project Area and Leakage Belt (in the baseline scenario), shows that there are growth trends for Groups 1 and 3 agents, followed by a lower growth of Group 4 agents that tends to increase in the medium and long term, in the case of Group 2 it presents reduction trends as described below.

According to IBGE's census data, the rural population in the reference region grew exponentially between 2000 and 2014. The growth average was 1,000 people per year in the city of Cujubim

[5] http://www.mma.gov.br/estruturas/sfb/_arquivos/miolo_resexec_polo_03_95_1.pdf

(ECOPORÉ, 2015). Considering that the region's economy is driven by timber and livestock activities, it is expected that agents from groups 1 and 3 will grow in the same trend as local population growth, since the performance of these agents has not been effectively curbed in the baseline scenario.

The analysis carried out in relation to the use of post-deforestation areas (Terraclass, 2012) has identified that about 40% of the deforested areas are abandoned, while the remaining 60% are mostly pasture areas (generally of low productivity). Such abandoned areas may in the future regenerate to a forest composition, however, they are generally re-occupied by other agents of group 3, in an attempt to obtain possession, once the area has been previously deforested.

The large proportion of abandoned areas shows the ease of mobility of these agents (groups 1 and 3), since they find low resistance to their perform, in addition, it demonstrates a growth in a lower proportion of agents of group 4, since there is no destination for the use of a considerable proportion of the deforested area, both for the initial activity of livestock, or for the agricultural production in a second moment. However, an increase in the growth of Group 4 agents in the coming years is expected, due to the accumulation of areas already converted and consolidated, but unproductive, in addition to the attraction generated due to the development of infrastructure, real estate speculation, prospects of economic development, among others aspects.

With regard to the agents of group 2, a reduction tendency is expected, where due to the unfeasibility of maintaining areas with forest, these agents, when they do not carry out deforestation in an attempt to value the property, choose to sell the area or abandon it after other agents invasions as already described in this Step.

Thus, with the maintenance of the activities of the baseline scenario, the population of groups 1 and 3 in the Reference Region, Project Area and Leak Belt is expected to grow as long as forest areas are available for advancement, accompanied by growth of agents of group 4 in the medium and long term, mainly due to the accumulation of areas with the consolidated land use conversion, but unproductive and abandoned by agents of groups 2 and 3.

e) **Historical deforestation statistics allocated to each agent in the reference region:** Based on the analysis of the land use type on the deforested areas up to 2010, conducted by TerraClass Project (EMBRAPA and INPE, 2011), it was identified that Squatters and Small Farmers are primarily responsible for unplanned deforestation in the reference region (Table 19).

Table 19 Relative contribution of deforestation observed per agent.

Agente	**Contribuition (%)**
Grupo 1	7
Grupo 2	18
Grupo 3	47
Grupo 4	28
TOTAL	**100**

Identification of Deforestation Drivers:

a) Variables that explain the deforestation amount (hectares)

Identification of deforestation drivers

- Illegal logging and allotments
- Cattle raising and agricultural production

Illegal logging and allotments

1. **Brief description:** The illegal extraction of wood in the remnant forest of the region, whether in private or public areas, feeds the sawmills located in the municipalities of the region of reference. After the removal of the hardwoods of greater economic value, often at the same time acting with the loggers (Group 1), the invaders began to act with the allotment of forest areas degraded by the illegal extraction, often the agent that extracts the wood does the illegal allotment (Group 3). The process of deforestation by these vectors does not necessarily occur in the same order, in some cases the invaders enter a certain area exclusively in the attempt to take possession, and in many cases, the wood is not even sold. According to the Socioeconomic Survey of Ecoporé (2015) there are many lots distributed in territories of conservation units and other areas where it was previously occupied by native forest, people occupying these areas generally avoid commenting on the destination of the wood that existed in the place, others if they want to live in allotments and only implement livestock farming with few heads of cattle in order to prove ownership of the land. The influence of these agents and vectors on certain areas is mainly motivated by the identification of ease of access and land fragility (some of the underlying causes). In areas where forest management is carried out or has been carried out at some time (Flonas and private areas), invasion cases are common, since forest management activity opens access infrastructures in the forest and often the size of areas makes it difficult to surveillance.
2. **Impact on agent's behavior:** Illegal logging is usually the first step for deforestation in the Amazon[6], as it usually causes progressive forest degradation by the extraction of wood of major commercial interest carried out by agents of group 1. After removal of larger trees, the agents carry out quick burning and cutting activities of the forest, many times to limit illegally sold lots (Group 3). Thus, this region is attractive in the decision to deforest areas by these agents of deforestation, as there are few

[6] INPE (2008): Technical-scientific report - monitoring of Amazon forest area by satellites.

preventive actions by the public power to avoid these actions (underlying cause). The occupation of new areas in the Amazon as a whole follows a cyclical pattern where the settlers (pioneers) who take possession of the land after (or together with) the logging action (Joint action of agents in groups 1 and 3), leave these areas over time searching for new areas for farming or go to the cities, and the old allotments now belong to producers holding higher financial resources.

3. **Development forecast:** Deforestation associated with illegal logging in the reference region tends to increase as timber can still be withdrawn with market value in areas where access is facilitated (Ecoporé, 2015). The context of real estate speculation in the region, linked to the lack of government commitment to control and strengthen environmental issues (main underlying causes), tends to move a scenario of continued degradation of forest remnants (with the removal of high value timber). The subsequent or concomitant occupation of degraded areas and invaded by squatters and small ranchers tends to occur at the same rate, since these agents are attracted by the same vectors that motivate the actions of illegal loggers. The increase and development of infrastructures (mainly access roads) tend to grow in the future due to the demand of large and medium-sized rural producers (Group 4). Given that the forest does not represent financial value, and the predatory removal of wood and livestock represent the main economic activities of the region, the agents of groups 1 and 3 consider such areas unproductive and liable to invasion so that the scenario of common practice is sustained. In addition, see the contextual scenario, there are no alternatives for the agents of group 2, who tend to sell their properties that will probably be deforested by the action of other agents.
4. **Measures to be implemented:** The advance of activities such as illegal logging and illegal allotments is directly related to the lack of economic perspectives of the mentioned agents, since there is practically no technical assistance and incentive to sustainable practices, such as forest management, management of non-timber products or to diversified agricultural activities. In addition to monitoring changes in forest cover, the project aims to act directly on the causes and motivations that lead to the actions of deforestation agents in the Reference Region. Therefore, the project plans to encourage and develop activities with the local actors, providing the strengthening of associations of rural producers through inventive to sustainable socioeconomic development, combining professional training and environmental education, focusing on the sustainable exploitation of forest resources. The actions proposed by the project (as described in section 2.2) aim to reduce, directly and indirectly, the deforestation explained by the agents and drivers already identified in the Reference Region, contributing to the reduction of the migratory context, reduction of unproductive

areas and changes in practices that lead to the degradation of remaining forest cover. The objective of the project with these actions is to offer new alternatives to the local population as a counterpoint to the scenario of environmental degradation in the region.

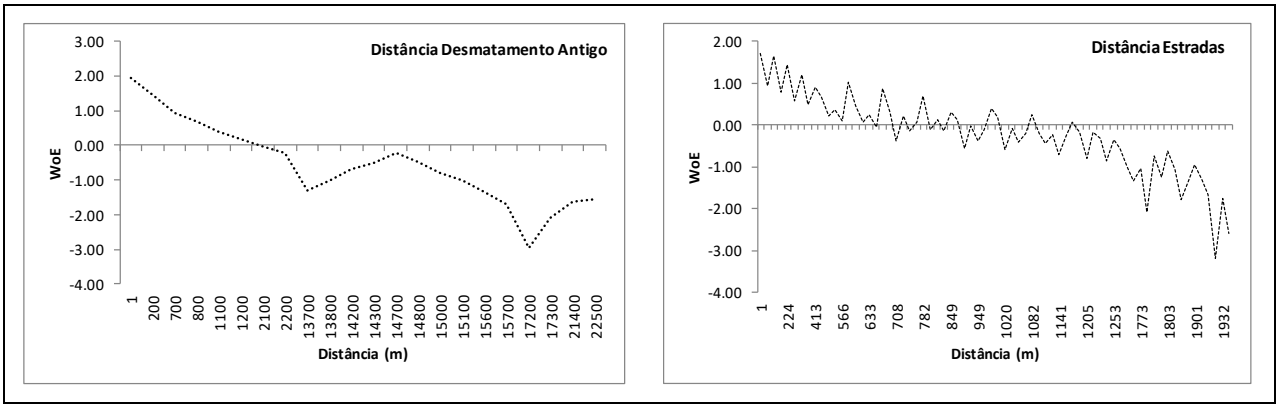
Cattle raising and agricultural production

1. **Brief description:** According to the socioeconomic survey carried out, livestock farming is the main land use in the region of reference, even with the growth of new activities such as monocultures (rice, soy). Livestock farming is still predominant and characterizes the first use given to the area after deforestation (Modus operandi of group 3 agents). The sector shows poor management techniques, and much of the pasture area produces little, resulting in abandonment and migration of these activities to other locations (Ecoporé, 2015). Recently, the expansion of monocultures, especially soybeans, has been strongly incorporated to areas previously used for the management of cattle raising and traditional agriculture. In this case the expansion of monoculture activities represents the growth of Group 4 agents in areas formerly occupied by agents in groups 2 and 3, fostering real estate expectation and the migration of these agents.
2. **Impact on agent's behavior:** Livestock farming allows Group 3 agents (squatters and small ranchers) and Group 4 (Rural producers of medium and large size) to start owning the land and capitalize quickly. The first agents of group 3 who take possession of the deforested areas form lots, implement livestock activities and seek to regularize the possession of the areas through false documents or of bribery of public agents. In the future, some squatters and small ranchers end up selling their land to large and medium-sized farmers and farmers, who expand their activities in the region. The lack of technical assistance and government investments for small producers reflects the abandonment of areas due to loss of income, this process feeds land speculation and causes the opening of new forest areas, characterizing the chain of events that relates agents, vectors and underlying causes of deforestation.
3. **Development forecast:** According to the study and data collected by the socio-economic report on the region (Ecoporé, 2015), the local economy is largely dependent on agricultural activities; thus, this sector tends to evolve due to the scarcity of wood and new government incentives. The region's agricultural dynamics tends to mechanized agriculture growth (monoculture), leading to replacement of pasture areas, which consequently demands new spaces, a factor that contributes to deforestation of new areas. From the socio-economic point of view, due to the probable future lack of wood

resources, the rural population tends to migrate to new exploration areas or to establish in agricultural settlements. The environmental initiatives taken by the government in the current context are weak, inefficient and often influenced by land interests, leading to a scenario of large scale properties and conversion of forest remaining areas into pastures.

4. **Measures to be implemented:** The strategy drawn up by the project to mitigate the actions and activity of deforestation agents related to Cattle raising and agricultural production will be based on the same measures described previously for Illegal Extraction of Wood and Allotments.

b) Variables to explain the location of deforestation: For the development of this step and step 4.2 of VM0015, eight variables were analyzed to identify which factors have a greater influence on the location of deforestation. In order to estimate the importance of the variables, was used the method of weights of evidence (WoE) proposed by Bonham-Carter (1994) and implemented in the software Dynamica EGO. The results were values ranging from -5 to +3, where positive values have a high influence and negative values represent a low influence of the factor in the occurrence of deforestation. The results of Figure 20 show that in the reference region, deforestation is more likely to occur in areas with close proximity to old deforestation and roads, as well as in private property areas on corrugated land.



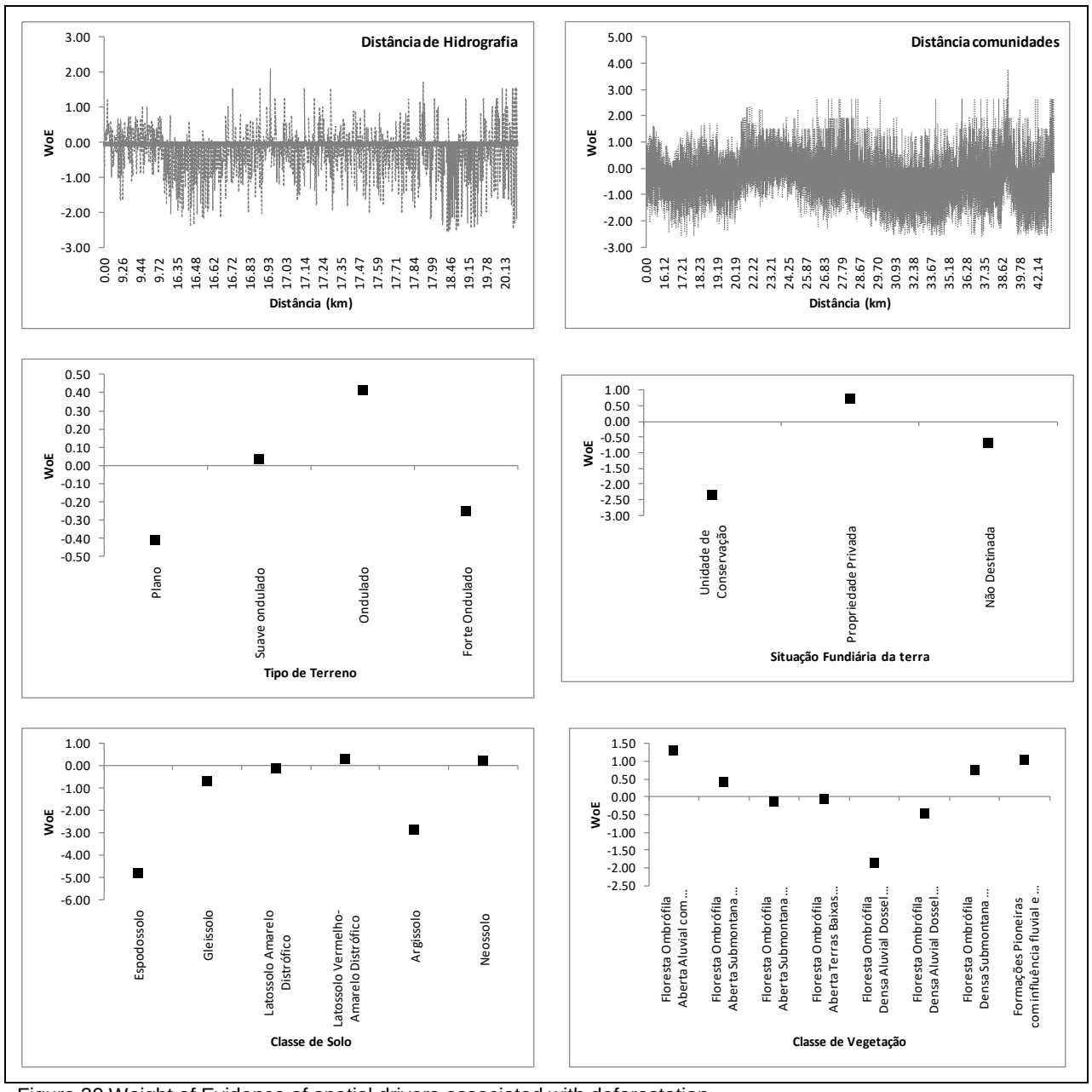


Figure 20 Weight of Evidence of spatial drivers associated with deforestation.

List of drivers that explain the location of deforestation:

- Distance to old deforestation

- Distance from roads
- Hydrography distance
- Distance from communities
- Land types
- Land situation
- Classes of soils
- Vegetation Classes

The description of the variables analyzed to explain the occurrence of deforestation in the historical reference period is presented below:

- **Distance to old deforestation:** represents forest edge areas that can be transformed into another type of cover due to proximity to previously deforested areas.
- **Distance from roads:** nearby forests of roads and branches are more accessible and thus become more susceptible to deforestation.
- **Hydrography distance:** nearby forests of rivers more than 10 meters wide are also more accessible and thus become more susceptible to deforestation.
- **Distance from communities:** proximity to an occupation center may result in a greater risk of deforestation.
- **Land types:** Four classes of terrain forms were analyzed and in the reference region, areas with smooth undulating and undulating terrain are more likely to be deforested.
- **Land situation:** in the reference region the land situation that is most likely to be deforested are areas of private property, followed by areas of land not designated by the public authorities.
- **Classes of soils:** of the six classes of soils analyzed, areas with the presence of Red-Yellow Latosol and Neosol have a greater probability of deforestation in the reference region.
- **Vegetation Classes:** the most likely class of vegetation in the reference region are areas with open Alluvial Ombrophylous Forest with palm trees, followed by areas with Pioneer Formations with fluvial and/or lacustrine - shrub influence with palms.

Deforestation underlying causes:

There are many studies that suggest the existence of several direct and indirect causes of deforestation in tropical forests, which are the result of a complex set of relations that contribute to forest reduction. Rivero et al. (2009) states that the underlying causes are related to the growth of markets and increasing demands for products that necessarily generate changes in land use. Population growth, cultural factors, integration of public policies for regional investment, land ownership insecurity, political factors, and impunity for environmental crimes are associated with such causes.

- **Brief description:** There are several underlying causes listed for deforestation in the Manoa Project Reference Region that are shared with other areas of the Amazon such as the opening of accesses in remote areas (roads and other infrastructures), the possibility of opening agricultural fronts and real estate speculation in previously inaccessible areas, the possibility of extracting natural resources such as wood, ore, among others (Ecoporé, 2015). In this context real estate speculation has a strong influence due to the direct or indirect incentive for deforestation, which leads various local actors (small and medium producers, squatters, and landless groups) to deforest forest areas (its own or from third parties by means of invasion) seeking valuation of the land that later can be acquired by large producers. In this context it becomes evident that the underlying causes that lead to deforestation are interrelated and are fomented by the inefficiency, absence, or even connivance of the Public Authorities (State) in the region, culminating in the incentive to illegal activities.
- **Development forecast:** Considering this scenario, with the increasing real estate speculation and the expansion of latifundia, the low level of agricultural productivity, caused mainly by the lack of technical assistance offered to small farmers, and considering the attractiveness generated by the rapid financial gain of the wood exploitation, tends to lead the region to an unsustainable environmental context by moving towards the domination of latifundia, increasing the marginalization of the population and increasing conflicts over land. Taking into account the high power of influence of the underlying causes listed, the described scenario shows no signs of change until practically all the forest cover of the reference region is removed or altered. Since such activities move the local economy, with the growth of monoculture activity on large farms, the reduction of logging activities and the scarcity of new areas for opening, it can be considered the stabilization or decrease of the rural population in the coming years, forming a Process in search of new job opportunities.
- **Measures to be implemented:** Regarding the hidden causes that converge for deforestation, the measures that should be adopted by the project are directly related to the context described for the

deforestation vectors and were reflected in the project activities section. The proposed activities are linked to actions to strengthen the rural associations in the region, strengthening the local economy on a sustainable basis, prioritizing the supply of employment to the community and local actors, prioritizing the sale of wood to local industries, and advising social organizations. In this way, the project intends to act directly in the promotion of a "green economy" that values the forest and its resources in a sustainable way and provides alternatives for the socioeconomic development of the local actors.

Analysis of chain of events that leads to deforestation

The chain of events leading to deforestation in the reference region follows the complex and typical pattern of the "deforestation arc" in the Brazilian Amazon. The many underlying causes that influence deforestation result in a complex chain of events, since local agents have different motivations and do not necessarily act in the same sequence of events.

The ease of access in a certain area attracts the attention of several local agents, where in general, the first actions occur by loggers in invaders, seeking to access the area for extraction of resources such as wood, hunting and fishing among others. Such agents usually opt to explore areas in Conservation Units such as Flonas (National Forests) where there are already infrastructures opened by the forest management and it is still possible to find valuable wood. In the context of private and non-titled areas, situations where all natural resource of value (wood) have been extracted are common, such areas are usually invaded by squatters or "landless" groups that in some cases sell wood or, in most of the cases, perform the deforestation solely in order to seek possession and valorization of the area. This context of common practice of invasions and deforestation aiming at real estate ownership and speculation is commonly called in the Amazon as "grilagem".

From the point of view of private areas that still have native forest, there are situations where the owner of the area does deforestation, assuming the risk of penalties, since there is no perspective of income generation by the forest within the property and the valuation of deforested area may even compensate for the payment of a fine for environmental crime. In cases where the owner chooses to carry out the forest management, it faces the various obstacles of legalized logging and must still cope with the external pressure exerted by groups of invaders, and in most cases, after the end of the exploration The landowner can't afford the cost of an area of unproductive forest, choosing the way of selling the property or being at the mercy of different groups of agents of deforestation.

After the deforestation event, carried out either by the landowner or by another agent, these areas usually follow two paths, with low yield crops and pastures, or abandonment of the area, resulting in areas with secondary vegetation and degraded vegetation. Abandoned areas are the result of low productivity and lack of prospects for smallholders settling in these areas, such agents abandon these areas in search of new opportunities, or when they obtain the title of ownership choose to sell the property to large producers.

Over time, such areas are converted to mechanized plantations, in the case of soybean or rice cultivation, displacing the previously mentioned actors to other places and generating pressure under new deforestation fronts. Figure 21 shows the chain of relationships identified among agents, vectors of deforestation observed in the reference region.

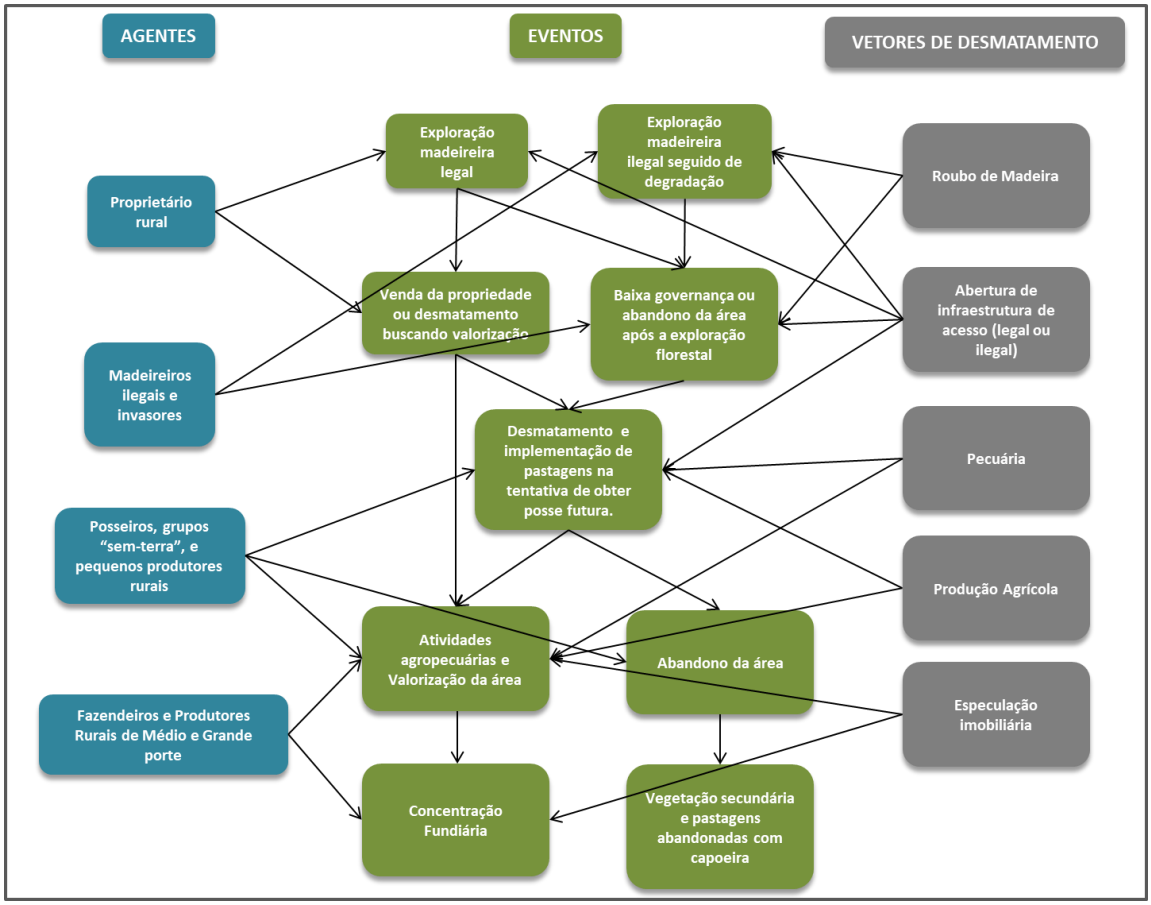


Figure 21 Analysis of chain of events that leads to deforestation.

Conclusion

From the data and information presented in the study by ECOPORÉ (2015), data on deforestation (PRODES, 2012), land use type (TerraClass, 2012) and the consultations of local specialists, it was possible to find conclusive evidence explaining the relationships between the agents, vectors, underlying causes and the pressure of deforestation in the reference region. In this way, the hypothesis presented is that the relationships between demographic variations, degradation and initial deforestation caused by inefficient management plans, the advance of agriculture and cattle raising, the growth of monoculture in large farms, land invasions often with the connivance of the State, contribute decisively for the deforestation scenario observed during the analyzed period. Considering these evidences, the tendency for the future baseline is to maintain the influence of the agents, causes and vectors evidenced during the historical period analyzed in the reference region, especially as long as there is a supply of wood and areas for agricultural expansion, whether in Conservation Units, private properties, or in other land tenure contexts with fragile governance and low economic returns.

VM0015 Step 4 - Future Deforestation Projection

Future Deforestation Quantity Projection (Step 4.1)

The reference region does not hold stratified limits, as agents, drivers, and causes of deforestation were considered equal throughout the area.

Selection of Baseline Approach

Despite of conclusive evidence concerning analysis of agents and drivers, deforestation rates observed in different sub-periods in the reference region did not show a clear increasing, maintenance, or reduction trend. The observed rate showed an increase in the first years (2000-2005), reduction between 2005 and 2009, and a new increasing trend from 2009 on (Figure 19). The land use changes dynamics in the region is complex and influenced by many variables, so even with conclusive evidence of activities conducted by agents and drivers in the region, it was not possible to establish a clear trend towards annual deforestation rates continuity in the future. This finding is reinforced by the low correlation between the deforestation annual rates, as evidenced by Figure 19 trend line.

In addition, a correlation analysis was performed between the data collected from the production of wood and cattle herd (IBGE / SIDRA) in the project region during the historical reference period and the deforestation evidenced in the same period. In this analysis, no variable had an adequate correlation index that could serve as the basis for a future projection of deforestation. Therefore, since the evaluation

of variables explaining deforestation (Figure 22 and Figure 23) showed a low correlation index, was chosen the "a" approach (historical average) to design the baseline of future deforestation.

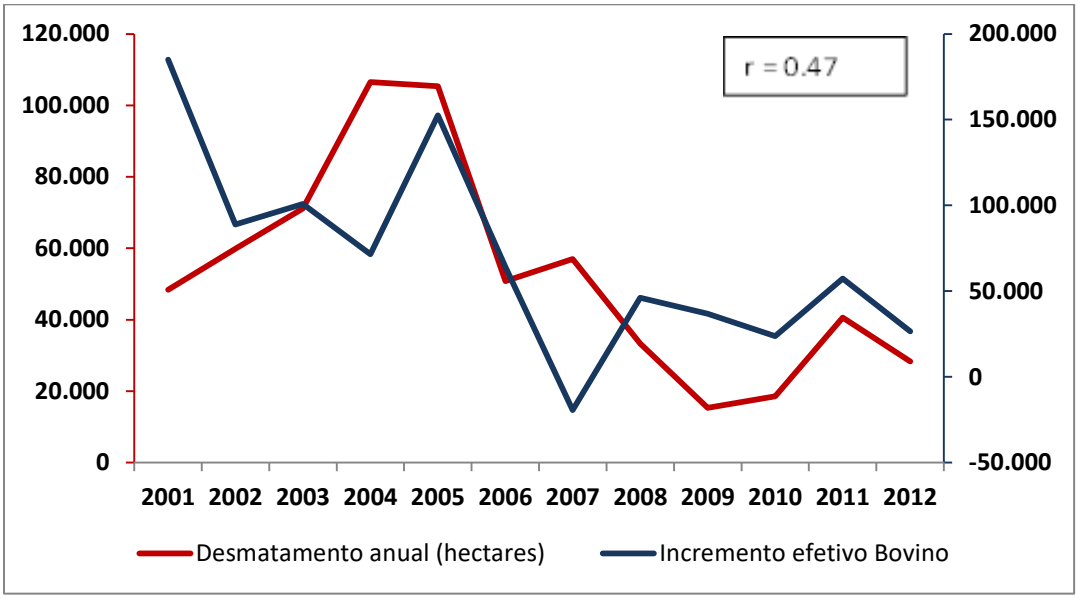


Figure 22 Correlation between variables "Deforestation" and "Bovine Cattle".

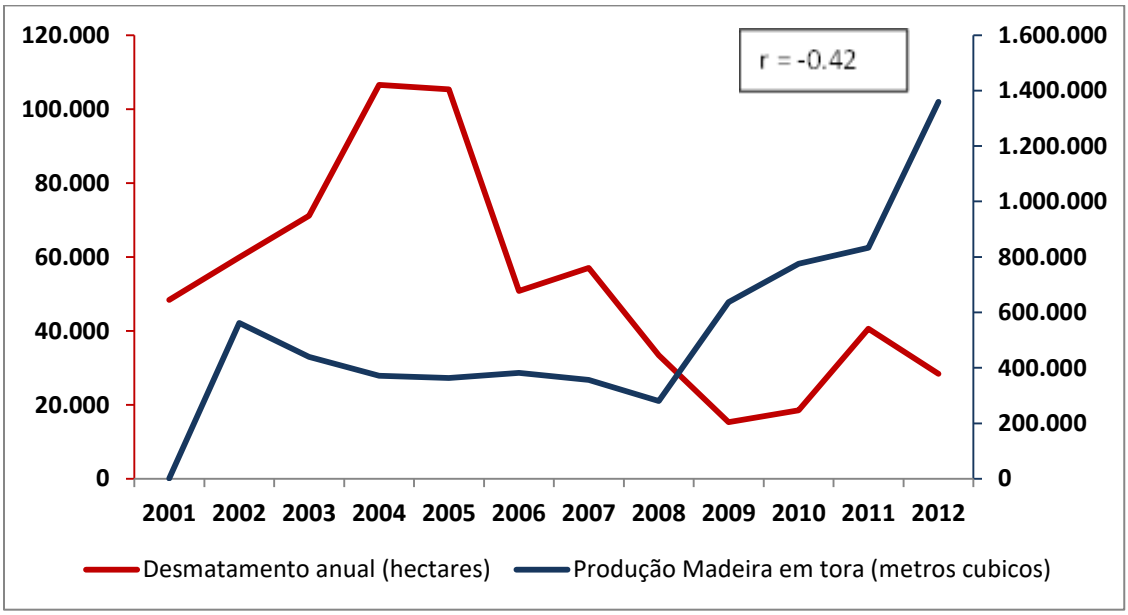


Figure 23 Correlation between variables "Deforestation" and "Wood production".

Annual projection of baseline deforestation areas in the reference region

The annual deforestation of baseline in year t for the reference region was calculated as indicated in equation 03 of methodology VM0015:

$$ABSLRRi,t = ARRi,t-1 * RBSLRRi,t$$

Where:

ABSLRRi,t: Annual deforestation baseline in stratum *i* inside the reference region in year t (ha/yr^{-1});

ARRi,t-1: Area with forest cover in stratum *i* inside the reference region in year t; (ha);

RBSLRRi,t:: Deforestation rate applied in stratum *i* inside the reference region in year t; (%);

Thus, the deforestation rate observed between 2000 and 2012 was calculated according to equation 07 indicated by Puyravaud (2003) and the value obtained was 0.79%. The deforestation amount projected for the 30-year period (2013-2042) in the reference region is shown in

Projection of annual baseline deforestation in the project area and leakage belt

The baseline deforestation for the project area and leakage belt was spatially projected for the entire reference region, according to recommendation of Methodology VM0015 step 4.2.4.

Summary of deforestation quantitative projection

This section presents future deforestation values projected for 2013-2042 in the Reference Region (Table 20), in the Project Area (

Table 21), and in the Leakage Belt (Table 22).

Table 20 Annual and accumulated deforestation for the Reference Region (VM0015 Table 9a.).

Project year *t*	Stratum *i* in the reference region	Total	
	1	annual	cumulative
	$ABSLRR_{i,t}$	$ABSLRR_t$	ABSLRR
	ha	ha	ha
2013	7.031	7.031	7.031
2014	6.975	6.975	14.006
2015	6.921	6.921	20.927
2016	6.866	6.866	27.793
2017	6.812	6.812	34.605
2018	6.760	6.760	41.365
2019	6.706	6.706	48.071
2020	6.653	6.653	54.724
2021	6.601	6.601	61.325
2022	6.550	6.550	67.875
2023	6.498	6.498	74.373
2024	6.447	6.447	80.820
2025	6.396	6.396	87.216
2026	6.346	6.346	93.562
2027	6.296	6.296	99.858
2028	6.246	6.246	106.104
2029	6.197	6.197	112.301
2030	6.150	6.150	118.451
2031	6.100	6.100	124.551
2032	6.052	6.052	130.603
2033	6.005	6.005	136.608
2034	5.958	5.958	142.566
2035	5.911	5.911	148.477
2036	5.864	5.864	154.341
2037	5.818	5.818	160.159
2038	5.773	5.773	165.932
2039	5.727	5.727	171.659
2040	5.682	5.682	177.341

2041	5.638	5.638	182.979
2042	5.593	5.593	188.572

Table 21 Annual and accumulated deforestation in the project area by 2040 (VM0015 Methodology Step 9b).

Project year *t*	Stratum i of the reference region in the project area 1 $ABSLPA_{i,t}$ ha	Total	
		annual $ABSLPA_t$ ha	cumulative ABSLPA ha
2013	198	198	198
2014	425	425	623
2015	469	469	1.092
2016	358	358	1.450
2017	674	674	2.124
2018	497	497	2.621
2019	713	713	3.334
2020	634	634	3.968
2021	715	715	4.683
2022	702	702	5.385
2023	806	806	6.191
2024	1.002	1.002	7.193
2025	826	826	8.019
2026	875	875	8.894
2027	861	861	9.755
2028	865	865	10.620
2029	890	890	11.510
2030	749	749	12.259
2031	847	847	13.106
2032	873	873	13.979
2033	919	919	14.898
2034	876	876	15.774
2035	763	763	16.537
2036	683	683	17.220
2037	782	782	18.002
2038	936	936	18.938
2039	938	938	19.876
2040	665	665	20.541
2041	817	817	21.358
2042	760	760	22.118

Table 22 Annual and accumulated deforestation for leakage belt 2040 (VM0015 Methodology 9c table).

Project year *t*	Stratum i of the reference region in leakage belt 1 $ABSLLK_{i,t}$ ha	Total	
		annual $ABSLLK_t$ ha	cumulative ABSLLK ha
2013	8	8	8
2014	108	108	116
2015	59	59	175
2016	16	16	191
2017	28	28	219
2018	47	47	266
2019	98	98	364
2020	88	88	452
2021	67	67	519
2022	86	86	605
2023	58	58	663
2024	92	92	755
2025	88	88	843
2026	138	138	981
2027	104	104	1.085
2028	134	134	1.219
2029	173	173	1.392
2030	130	130	1.522
2031	238	238	1.760
2032	162	162	1.922
2033	125	125	2.047
2034	150	150	2.197
2035	214	214	2.411
2036	269	269	2.680
2037	143	143	2.823
2038	171	171	2.994
2039	212	212	3.206
2040	199	199	3.405
2041	156	156	3.561
2042	173	173	3.734

Projection of Future Deforestation Location (Step 4.2)

Future deforestation location projection was found through Dinamica-EGO software version 2.0.10. This software is indicated by VM0015 methodology (p. 51) as an appropriate model for REDD+ projects baseline modeling. The selection for Dinamica-EGO was made the following reasons: a) it is a model available in the scientific publications of Soares-Filho et al. (2006), Yanai et al. (2012) and Vitel et al (2013); b) it holds transparent process for input and output of data and parameters processed with user-friendly graphical interface; c) it incorporates the use of appropriate data to explain the location of deforestation; d) it holds proper tools to evaluate uncertainties (Hagen, 2003).

The main steps conducted with Dinamica-EGO at this stage was: (i) organization of maps on land use and land cover, and maps with deforestation explanatory factors; (ii) model calibration by determining the weight of evidence and analyzing correlations between variables; (iii) assessment of model accuracy; (iv) development of deforestation baseline scenarios. Dinamica-EGO used spatial data with 100 x 100 m pixel size, GeoTIFF format, 1557 rows by 1385 columns dimension.

Preparation of factors maps

This step was carried out applying the empirical approach to the create factors maps found in Figure 24. Studies on deforestation in the Amazon (IMAZON, 2011) show that maps of landscape distances and spatial attributes (roads distance, previous deforestation distance, vegetation type, etc.) have high correlation with the location of new deforestation. Dinamica EGO, to draw the map and calibrate the model, requires independent input spatial variables. Thus, eight independent spatial variables were used to produce the deforestation risk map as described previously in Step 3.2 (Table 23).

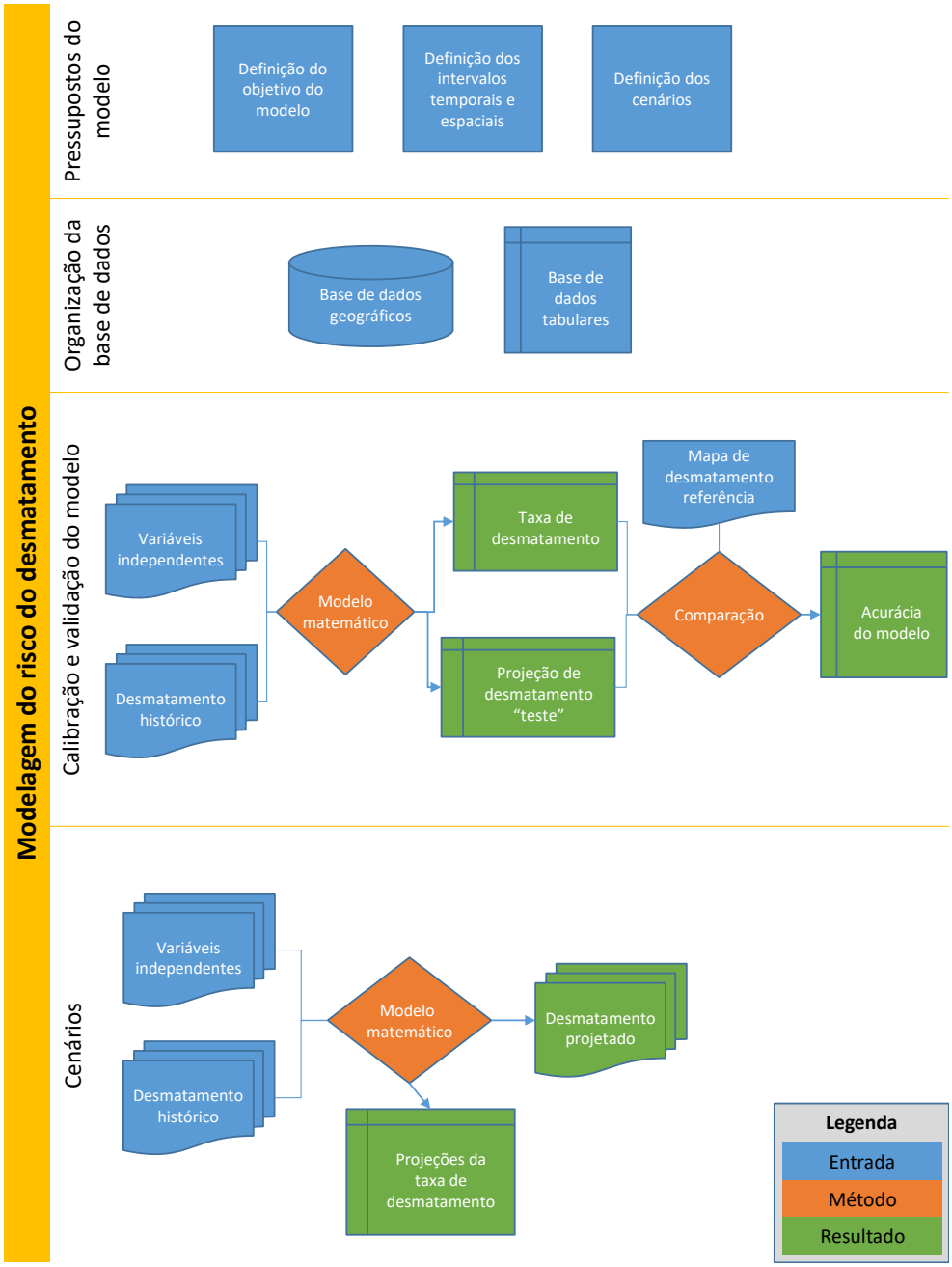


Figure 24 Flowchart of the deforestation projection model.

Table 23 List of maps, variables, and factors maps (VM0015 Table 10).

Factor Maps		Source	Variable represented		Meaning of the categories or pixel value		Other Maps and Variables used to create the factor Map		Algorithm or Equation used
ID	File Name		Unit	Description	Range	Meaning	ID	File Name	
1	distance_to_1	INPE	Metros	Dados contínuos	0-22.500	Distância desmatamento antigo	1	lulc2000.tif	Distancia euclidiana (Dinamica EGO 2.0.10)
2	d_estrada	DSG	Metros	Dados contínuos	0-14.413	Distância estradas e ramais	2	estradas_clip.shp	Distancia euclidiana (ArcGIS 10.1)
3	c_landternure	IMAFLORA	Categorias	Categorias de situação fundiária	1-4	1 = Áreas protegidas 2 = Propriedades Privadas 3 = Terras não Destinadas 4 = Outros	3	a2_lot_11_final.shp	-

4	c_vege	IBGE	Categorias	Classes de vegetação	1-9	1 = Floresta Ombrófila Aberta Aluvial com palmeiras 2 = Floresta Ombrófila Aberta Submontana com cipós 3 = Floresta Ombrófila Aberta Submontana com palmeiras 4 = Floresta Ombrófila Aberta Terras Baixas com palmeiras 5 = Floresta Ombrófila Densa Aluvial Dossel emergente 6 = Floresta Ombrófila Densa Aluvial Dossel uniforme 7 = Floresta Ombrófila Densa Submontana Dossel emergente 9 = Formações Pioneiras com influência fluvial e / ou lacustre - arbustiva com palmeiras	4	vegetacaoClip.shp	-
5	c_solo	IBGE	Categorias	Classes de solo	3-10	3 = Espodossolo 6 = Gleissolo 7 = Latossolo Amarelo Distrófico 8 = Latossolo Vermelho-Amarelo Distrófico 9 = Argissolo 10 = Neossolo Litólico Distrófico	5	pedologiaClip.shp	-

6	c_terreno	INPE	Categorias	Tipos de terreno	1-4	1 = Plano 2 = Suave ondulado 3 = Ondulado 4 = Forte Ondulado	6	relevo.tif	-
7	d_hidro	IBGE	Metros	Dados contínuos	1-20.705	Distância da hidrografia principal	7	hidro_ibge_diss.shp	Distancia euclidiana (ArcGIS 10.1)
8	d_localidade	IBGE e DSG	Metros	Dados contínuos	1-46.360	Distância de comunidades	8	localidades2.shp	Distancia euclidiana (ArcGIS 10.1)

Development of deforestation risk maps

Deforestation risk maps show the regions with the highest (risk close to 1) or lower conditions for possible deforestation (risk close 0). This project risk map was produced by the Weight of Evidence (Bonham- Carter, 1994), available from Dynamic EGO, which calculates the probability of transition from forest to deforested area in each pixel of the reference region. This probability is calculated based on the sum of all weights of evidence that overlap over a certain pixel, and depend on combinations of all static and dynamic map (Soares-Filho et al 2006).

The result of applying the weights of evidence method in Dinamica EGO is a a deforestation risk map. This map (Figure 25) identifies areas with higher and lower conditions for the occurrence of deforestation. The deforestation risk map, together with other spatial variables shown in Figure 20, is the starting point for the generation of future deforestation baseline scenarios.

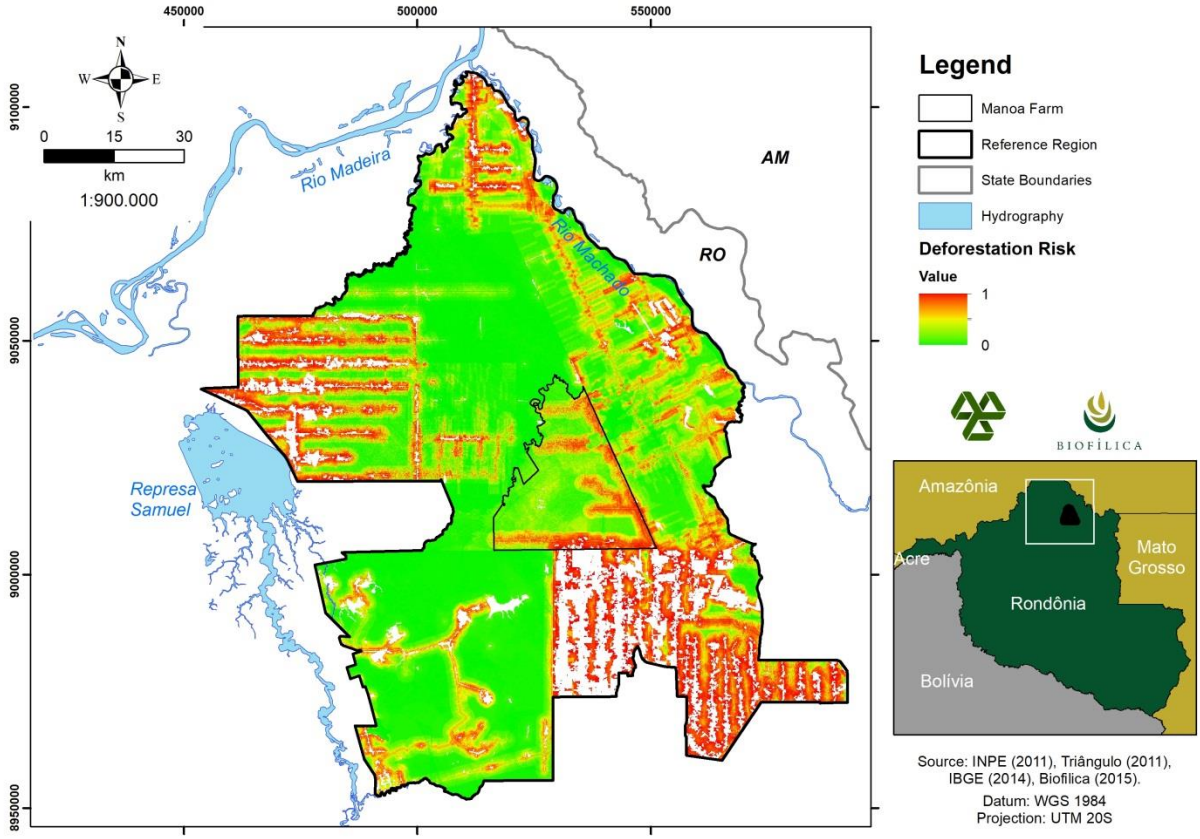


Figure 25 Transition potential map for occurrences of deforestation in the reference region.

Selection of risk map to the most accurate deforestation

The assessment on the quality of the generated model was conducted applying option “a” - calibration and confirmation using two historical subperiods - available in VM0015 methodology version 1.1 (page 53). Deforestation data, occurred between 2000 and 2007, were used to calibrate the model, while the deforestation map occurred by 2012 was used for the confirmation process. In this process, a deforestation map for 2012 was simulated from the data observed in the years 2000-2007.

The FOM technique *(Figure of Merit)* was applied to evaluate the accuracy of the map simulated in 2012. The FOM is the reason of the intersection of observed changes (changes between reference map at time 1 and time 2), and simulated changes (changes between the reference map at time 1 and the

reference map at time 2), to gather the observed change and the expected variation, according to VM0015, equation 9.

This method points out that the minimum threshold for the best adjustment measured by FOM must be defined by the net change observed in the reference region for model calibration period. The net change observed must be calculated as the total area of change being modeled in the reference area during the calibration period, as a percentage of the total area of the reference area, and the FOM value should be the minimum equivalent to this amount. If the FOM value is below this threshold, the project proponent must demonstrate that at least three models were tested (resulting in at least three risk maps), and the one with the best FOM was used.

The threshold of net changes observed in the reference region was 0.07, and the FOM value obtained by applying VM0015 equation 9 was 0.73; thus, as the FOM for the first produced risk map is above the minimum threshold, it was not necessary create other two models to perform the allocation of the future deforestation (VM0015 Step 4.2.4). Thus, the deforestation risk map developed at this stage showed acceptable accuracy to project land use changes by 2042 at Manoa Farm REDD+ Project reference region.

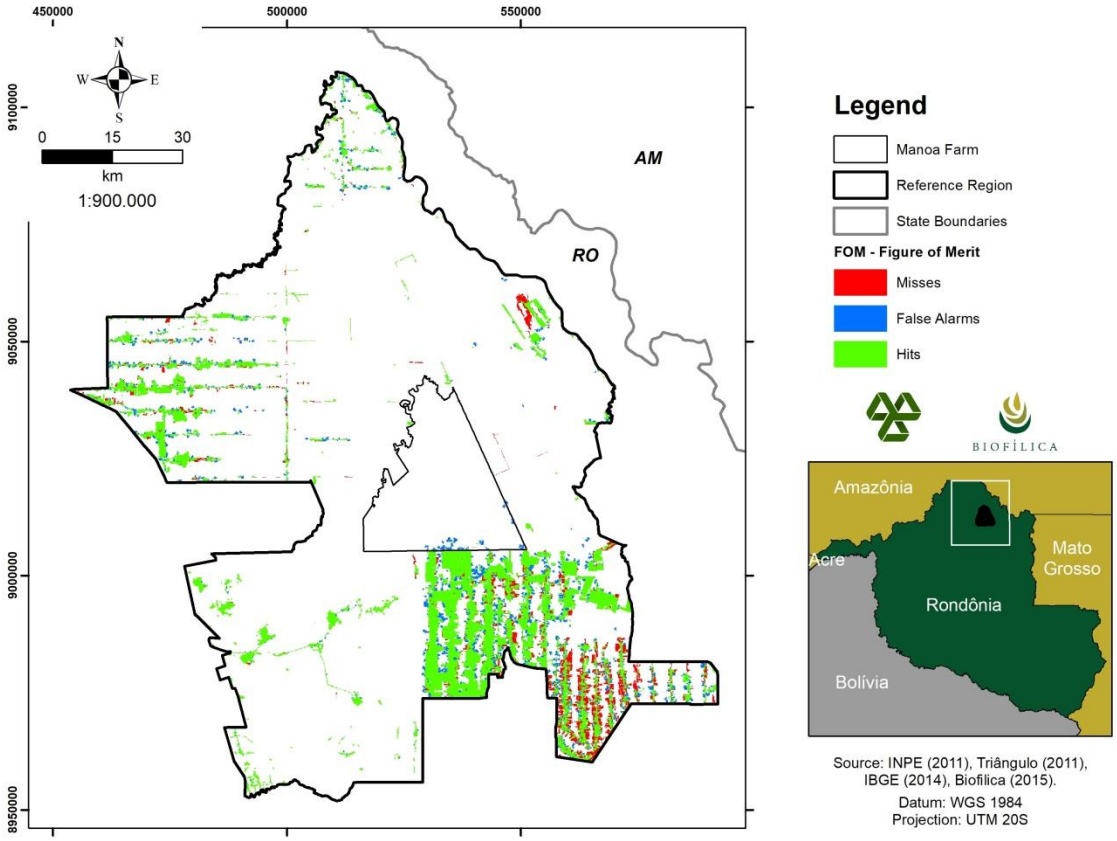


Figure 26 Demonstration of model evaluation method with FOM tool.

Mapping of future deforestation location

The procedure to select the pixels with the highest risk of deforestation, based on the rate of deforestation defined in step 4.1, and the elaboration of the deforestation baseline maps was performed automatically by the EGO Dynamica the period of 30 years, from 2013 The result is shown in Figure 27 and Figure 28 with deforestation in the Reference Region predicted by the year 2042, and in the Project Area for the first fixed baseline period (2022).

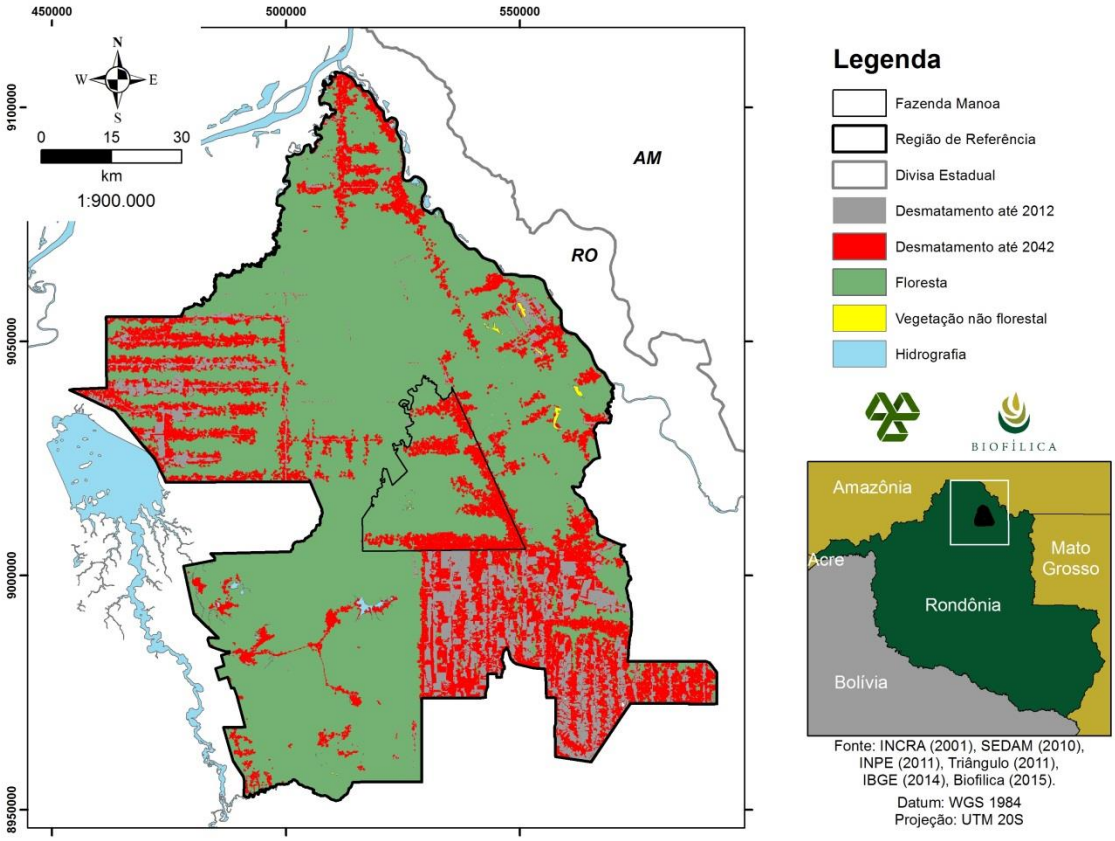


Figure 27 Baseline deforestation in the Reference Region for 2042.

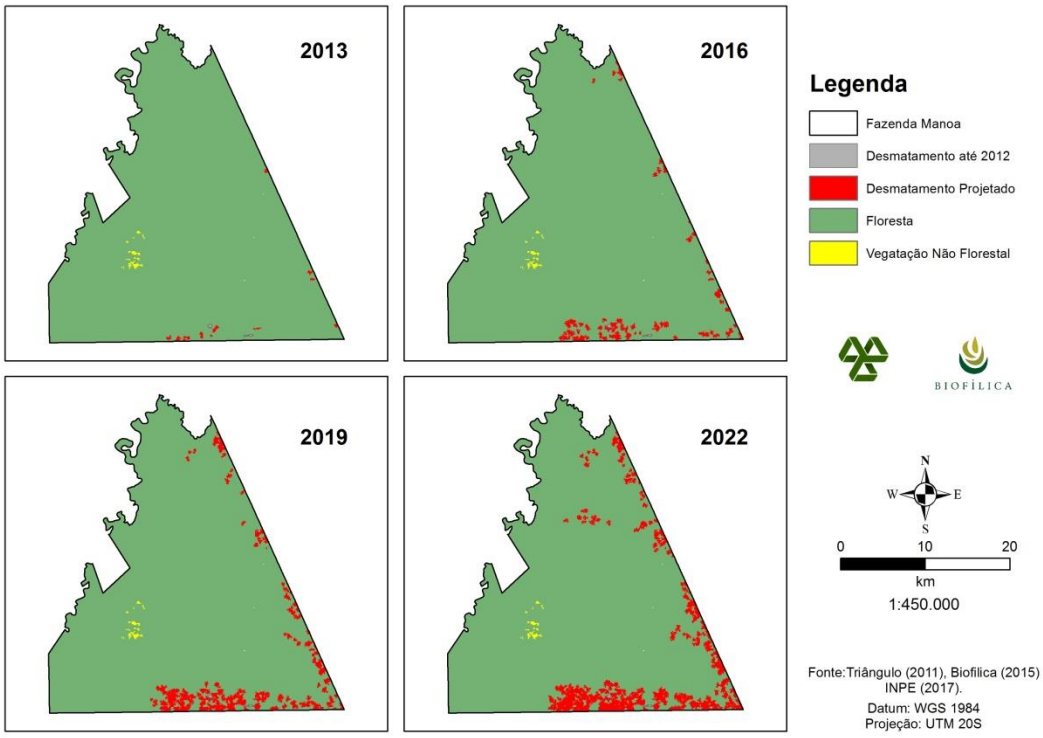


Figure 28 Deforestation projection for the first 10 years of the project.

4.6 Additionality (G2)

The additionality of the project was analyzed according to the tool approved by VCS "VT0001 - Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities", version 3.0, of February 1, 2012.

The tool's applicability conditions are met because:

• The AFOLU activities are equal or similar to the design of the proposed activities within their respective limits or registered as Project VCS AFOLU, and do not lead to a breach of any applicable law even if this law is not applied; and

• The VM0015 baseline methodology provides a step-by-step approach to justify the determination of the most plausible baseline scenario (see "Part 2 - Methodology Steps for ex ante estimation of GHG Emissions Reductions" of VM0015).

Step 1. Identification of alternative scenarios of land uses proposed by the VCS AFOLU project activity

Sub-step 1a. - Identify alternative scenarios credible land use to the VCS AFOLU project activities proposed

The scenarios described in this item were based on the data collected by the socioeconomic study conducted in 2014, which included the use of secondary (literature review) and primary data, resulting from interviews and reports of residents and representatives of local institutions.

Among the alternative scenarios for the use of realistic and credible soil that occur within the project boundary in the absence of activity AFOLU Project registered in the VCS, they were considered:

i) Continuation of land use activities prior to Project (baseline scenario):

The history of deforestation in the reference region of the project is strongly influenced by factors such as the growth of the timber sector, land fragility and the implementation of low productivity agricultural activities. The common practice scenario was sustained for many years by logging in private, non-titled areas and settlements, where after the forest logging potential was exhausted, the areas are abandoned and/or invaded and subsequently fully open for pasture. Across the region, squatter agents adopt the strategy of invading abandoned, fragile or indefinitely owned areas to implement agricultural activities and build housing seeking to secure possession of the area, such strategies are obviously motivated by inefficiency or even lack of supervision by part of the public authorities.

The growth of the agricultural sector, coupled with the prospect of a decline in the timber sector in the coming years, has led to a great appreciation of pasture areas to the detriment of forest areas (Ecoporé, 2015 and FNP, 2016), a fact that motivates landowners With forest to clear or sell their areas, since the implementation of management plans is extremely bureaucratic, costly and does not guarantee competitiveness with illegal timber. This context encourages deforestation throughout the region, since squatters also adopt the strategy of opening new areas in order to value them in an attempt to sell them in the future.

There is no sign of a change in the region's current scenario, since in addition to the low efficiency of public authorities in monitoring and punishing environmental crimes, there are not suitable measures to provide the valorization of the forest as an asset that enables the generation of sustainable income for the population. Just as forests are exploited to the point of exhaustion, agricultural activities follow the same course, due to the low level of training and technical assistance, the degraded and unproductive agricultural areas proliferate in the region, resulting in pressure under new areas.

Between 2000 and 2012, 107,988 hectares were deforested in the reference region of the Project to install these activities. For the next 30 years, a loss of 188,572 hectares is projected in this scenario, of which 22,118 hectares are expected to be deforested in the Project area. In the described scenario, this cycle tends to repeat itself until all the forests in the region are deforested and all local biodiversity is lost. This context also entails a great social burden in the project region, since the chain of deforestation events generates and potentiates a series of social problems, related to unemployment, migration, lack of perspectives, among others.

ii) Certified Forest Management with REDD+ activities without registration as a VCS AFOLU Project:

This scenario represents the conduction of FSC certified sustainable forest management activities along with complementary activities to contain and monitor deforestation caused by the agents of the scenario "i" and social activities described in Section 2.2.

Sustainable forest management, notably the certified, is recognized by several experts as a tool for forest conservation, maintenance of forest carbon stocks and reduction of deforestation rates (PORTER-BOLLAND et al., 2012; UNCED, 1992; VERÍSSIMO et al., 1992; SILVA et al., 1997; UHL et al., 1997; BARRETO et al., 1998; HOLMES et al., 2002 apud SABOGAL et al., 2006; PUTZ et al., 2008; SPATHELF et al., 2004). This is mainly due to the application of low impact exploration techniques, continuous monitoring of the forest and the social and environmental impacts of the operation, physical presence, land organization and generation of economic value for forest areas.

However, following the context described in scenario "i", in the project region, Forest Management (when approved and certified) is not considered an economically advantageous practice, since there are several barriers for the owner who wishes to follow this path . The implementation of a certified management plan is bureaucratic and costly, where the owner must comply with various rules and apply a large investment. Even so, the implementation of a certified management plan does not

guarantee advantages in the market, where the product competes with the supply of illegally and / or doubtful wood origen, forcing the responsible entrepreneur to reduce its price and its profit margin . In addition the forest owner needs to live everyday with the outside pressure under the area, since at the first moment of fragility it will surely be invaded.

In contrast to the reality of legalized logging, the opening of areas for the implementation of agricultural practices is much more advantageous, since the surveillance is inefficient, the area values in more than five times the initial value, and the costs of implementation and maintenance in general are substantially smaller.

In the midst of so many barriers and adversities, the owner often chooses to sell his property because he can't afford management activities and deal with market uncertainty, besides that, at moments of financial crisis can lead to fragility in property security that would certainly entail invasion of the property.

In this context, specific investments are necessary (Specialized professionals, acquisition of satellite images, technical studies specific to REDD, intensification in surveillance and patrimonial security, implementation of courses and seminars with the social actors of the environment, strengthening of local associations of producers, improvement of biodiversity monitoring, among others) for the effectiveness of the Project in relation to the containment and monitoring of deforestation that threatens the project area and activities that foster local socioeconomic development.

Since such investments are not mandatory, and in general not carried out by certified forest management, these activities could hardly be practiced in the regional scenario, hindering or preventing the generation of positive net impacts in the region. Therefore, the economic viability of the management is reduced even more, without the addition of the additional revenue resulting from the commercialization of the credits registered in the VCS.

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

From a project viewpoint, in the proposed scenarios, scenario II is in compliance with all applicable legal and regulatory requirements, on the other hand, the practices in scenario I are not in accordance with mandatory legislation and regulations.

This occurs as illegal logging, or unauthorized, is a systematic and widespread in Amazonia and especially in the project area, located in the "Arc of Deforestation". Following Higuchi, et al (2009) 1997-

2003 authorized the deforestation rate was 19%, ie 81% of the identified deforestation were not authorized by public bodies.

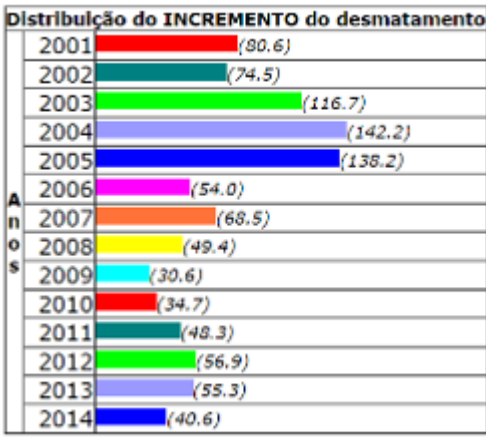
Considering the smallest administrative unit in the municipality of Cujubim, and the environmental regulations Law 12.651 / 2012 (New Forest Code) and the State Decree 9,605 of 1998, which deals with the suppression of native vegetation with a pre-licensing condition, one can observe an increase in deforestation year by year as well as in accumulated value (Figure 29).

In this comparison, data from PRODES[7] and the environmental licenses issued by SEDAM[8] were used. Cujubim has permits totaling an area of 4,523 hectares of potential for illegal logging. Thus, the great majority of deforestation in Cujubim (more than 95%) occurs in an illegal situation due to lack of approval from the environmental agency (SEDAM), which demonstrates that the laws are systematically not applied.

[7] ttp://www.dpi.inpe.br/prodesdigital/atrmunic.php?ID=1100940&ano=2014&

[8] http://monitoramento.sedam.ro.gov.br/simlam/

Classes	2014	
	Área (km 2)	%
Total deforestation	1632.2	41.81
Increment/previous year	40.6	1.04



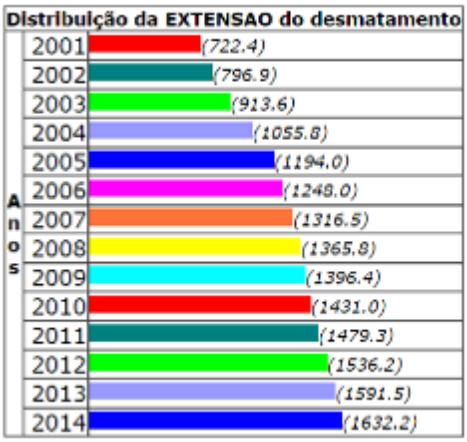


Figure 29 Distribution and increase of deforestation in Cujubim.

Sub-step 1c. Selection of the baseline scenario

Described in Section 4 - Methodology Application, item 4.5 Baseline Scenario.

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method

As the project generates financial benefits beyond the income related to loans recorded in the VCS through the marketing of tropical timber, a comparative investment analysis (Option II) of alternative scenarios to determine the project's additionality was applied. We analyzed the scenarios “i” and “ii”.

Sub-step 2b. Option II Application of comparative investment analysis

The Net Present Value (NPV) was selected as a financial indicator for investment comparison analysis of alternative scenarios. The VPL is one of the methods used by companies to assess projects and has the following advantages over other indicators: (i) take into account the value of money over

time; (ii) the NPVs can be added; and (iii) depend only on cash flows and cost of capital (LEMES JR, 2005). The economic analysis in question did not take into account the influence of inflation in the scenarios evaluated.

Sub-step 2c. Calculation and comparison of financial indicators

The summary of sources of income and expenditure considered in the analysis is presented in Section 2.2 of this document (Description of Project Activities), where the proposed activities to contain/monitor unplanned deforestation and generate net benefits to the climate, communities and biodiversity are described in detail.

Table 24 Scenarios and their sources of income and expenses.

Scenario	Incomes	Expenses
(i) Sustainable Forest Management, **without** complementary activities to contain/monitor unplanned deforestation and **without** additional activities to benefit the climate, communities and biodiversity.	Sale of tropical timber from sustainable forest management.	(-) Sustainable Forest Management;
(ii) Sustainable Forest Management, **with** complementary activities to contain/monitor unplanned deforestation and **with** additional activities to benefit the climate, communities and biodiversity.	Sale of tropical timber from sustainable forest management.	(-) Sustainable Forest Management; (-) Additional activities to contain/monitor unplanned deforestation and climate, communities and biodiversity;

The free cash flow scenarios and comparative NPV analysis took into account the sources of income (Sale of tropical timber) and expenses described in Table 24 and a discount rate of 25%. Such discount rate has been applied for all project scenarios and is intended to reflect the investment risk at a present value in comparison to the scenarios analyzed by the investor.

For this analysis scenarios I and II were compared, in other words, "without REDD+" scenario versus "REDD+" scenario, both scenarios not considering the input of additional income besides the commercialization of timber already carried out by Manoa. In scenario I, "without the project", the only activity is forest management. In the scenario II scenario, "with the project", the activities of scenario I are added to the framework of additional activities proposed for the REDD+ Project.

As input data for the financial economic model were used in scenario I: Volume of timber harvested, average price of timber commercialization, operational expenses, operational investments, taxes, payroll, among others. In scenario II, the same expenses and cash flow of scenario I were considered. However, the expected expenses for REDD+ Project activities were added as: Monitoring of

forest cover, investments in surveillance, technical training and rural technical assistance, research and monitoring of biodiversity, among others.

The detailed information and documents related to the financial economic model are considered commercially sensitive and were shared with the audit team on a confidential basis.

A conservative analysis until the year 2042 revealed a NPV of R$4,057,607 for scenario I, and a NPV of R$203,752 for scenario II. The analysis of scenario II presented a positive NPV, however much lower than the other scenarios. In this way, it becomes evident that the complexity related to the implementation of such activities, added to the risks and barriers inherent in the forest management activity make the investment unfeasible. In addition, the analysis of scenario I don't take into account the risk of asset loss or deterioration (the forest) due to the influence of external agents. Thus, the evaluation demonstrates that additional forest management activities to contain/monitor deforestation and generate net positive benefits to climate, communities and biodiversity reduce the Project's financial viability if there is no additional revenue added, such as that resulting from commercialization of credits validated by VCS.

Even considering the additional income from scenario III, the analysis presented a lower NPV than scenario I, mainly due to the large investment made in the first years of the project. However, the proponents believe that the implementation of the REDD + project will guarantee the integrity of the forest cover in the area and support the quality and longevity of the forest management activity in times of instability. In addition, from a financial point of view, the possibility of diversifying revenue brings greater security to the venture and reduces the risk to the investor. Therefore, considering the context described, scenario III provides greater security to the investor in relation to the other scenarios.

NPV SCENARIO I BAU - tx desc - 25%	**4.057.607**
NPV SCENARIO II - tx desc - 25%	**203.752**

Sub-step 2d. - Sensitivity Analysis

Table 25 presents the Critics assumptions of the scenarios I and II and its variations, considered reasonable, used in the sensitivity analysis. In Panorama 1 were considered pessimistic variances and 2 optimistic. The basic values are those considered for comparative analysis of the NPV in Sub-step 2c.

Table 25 Critical assumptions for the scenarios (i) and (ii) used and variations in the sensitivity analysis.

Scenario	Premise	Panorama	
		1 – Pessimistic	2 – Optimistic
(i) Sustainable Forest Management, **without** complementary activities to contain/monitor unplanned deforestation and **without** additional activities to benefit the climate, communities and biodiversity.	Tiber price	80% of base value	120% of base value
(ii) Sustainable Forest Management, **with** complementary activities to contain/monitor unplanned deforestation and **with** additional activities to benefit the climate, communities and biodiversity.	Timber price	80% of base value	120% of base value
	Custos Atividades de REDD+	Fixo	Fixo

The optimistic panorama presented attractive results in relation to the scenarios analyzed, however the common practice context of the region evidenced in sub-step 1.a does not show optimistic tendencies in the future. The studies carried out by the project evidenced the lack of perspectives for the local actors and the tendency of continuity of the influence of the identified agents and vectors, showing low probability of occurrence of optimistic perspectives.

Pessimistic	
NPV SCENARIO I BAU - tx desc - 25%	(801.067)
NPV SCENARIO II - tx desc - 25%	(4.654.922)

Optimistic	
NPV SCENARIO I BAU - tx desc - 25%	8.934.368
NPV SCENARIO II - tx desc - 25%	5.080.513

Figure 30 shows the annual logging volume of the Manoa farm, the analysis shows a marked downward trend in the quantity of wood exploited by forest management, mainly due to market instability and a tendency to reduce wood consumption, since much of it is sold in the region. During the analyzed period, the amount of wood harvested fell by 30% when comparing two subperiods (2011-2013 and 2014-

2016). In the second period, the exploitation intensity per hectare was below 20 cubic meters in each year (limit Minimum estimated by the company).

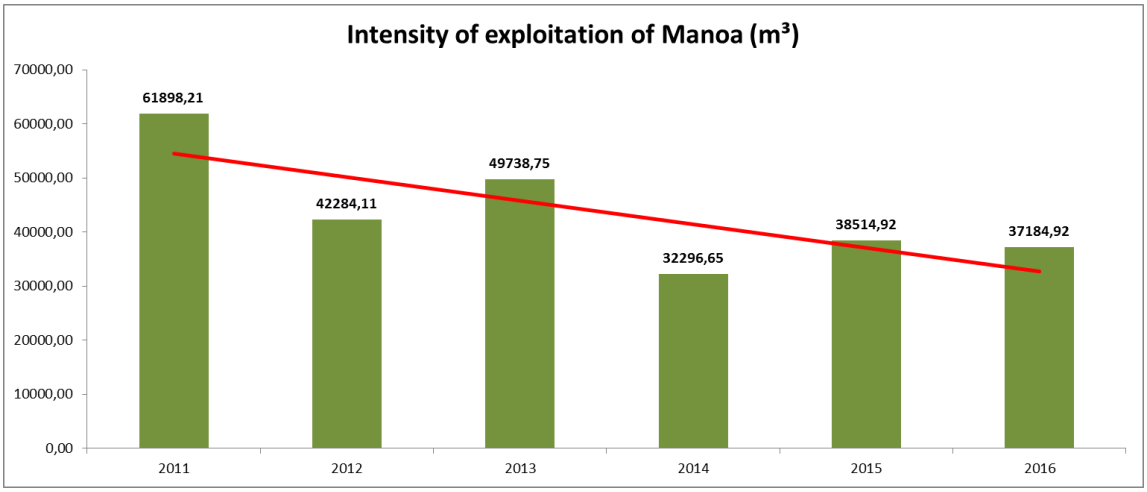


Figure 30 Variation of timber harvested at Manoa farm.

The high volume recorded in 2011 is still a reflection, according to Manoa employees, of operations of environmental agencies against illegal loggers in the municipality of Cujubim in 2009 (Operation Arc of Fire), which positively reflected the certified management activity, since it reduced the supply of timber in the market.

Thus, although Manoa's forest management has positive results, the activity coexists at all times with market instability and competition with illegal timber, since certified wood does not necessarily result in a competitive advantage in the market. Thus, the analysis focused on the volume of wood exploited by the company does not indicate tendencies of positioning of forest management in the optimistic panorama analyzed.

The sensitivity analysis strengthens the conclusion that the REDD+ Manoa Project is not considered to be financially attractive without registration as a VCS AFOLU project and the additional revenue derived from credit sales, the low perspective of an optimistic panorama regarding forest management activity reinforces the importance of the additional resource to finance the proposed activities.

The financial models used in the analyzes of Sub-steps 2c and 2d are available to the validating/verifying bodies.

Step 3 - Barrier Analysis

The VCS "VT0001 - Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities - requires investment analysis (Step 2) or Barrier Analysis (Step 3). In this case, we opted for the Investment Analysis, already described in Step 2.

Step 4 - Common Practice analysis

Scenario I described as a baseline scenario, or common practice scenario, indicates that there are not many outputs to forest management in the project region. As already contextualized previously, the timber sector is falling in the region, a fact that has directly influenced the market and further devalued forest areas. In this scenario there is no incentive for the entrepreneur to remain in the certified management business and to continue to preserve his area. The most common practice in these cases leads to the choice of sale of the property, in the attempt to acquire a license to deforest part of the property seeking valuation of the property, or in invasions by third parties due to the fragility generated by the decline in forest management.

In the region where the project is located, there are innumerable cases where management plans are approved by the responsible body in which, after the forest exploitation, the areas are totally invaded. Such intrusions usually occur because the owner is unable to maintain the area after the cessation of the management activity. In some cases, the deforestation of the area is carried out by the landowner himself, knowing that even if he receives a fine, the valorization of the deforested area compensates for the risk of a possible penalty.

For the common practice analysis was chosen an area southeast of the Manoa farm (Figure 32) called Seringal Urupá. This area was leased by the owner for a third party to carry out the forest management, of the total area of the property, 6,750 hectares were designated to carry out one of the management plans (Figure 31), which was divided into five Annual Production Units (UPA). During the entire period that the area was exploited the lessee suffered with the constant pressure of groups of settlers and squatters of the surroundings. Without any resistance and governance after the finalization of the management plan in 2012, the area was totally invaded.

Figure 31 Plate indicating the accomplishment of the Management Plan in the area.

The mapping carried out by PRODES clearly shows that after the finalization of the management plan the area began to be invaded and deforested (Figure 32). The shape of the identified deforestation presents the same pattern of other deforested areas in the surroundings, configuring a classical spatial distribution of areas invaded by squatters and settlers.

The common practice analysis evidences the thesis that the same invasion event could have occurred at the Manoa farm if the property had not taken measures to strengthen security and governance. At the same time, forest management coexists daily with market uncertainties, which further weaken the management activity, reinforcing the additionality of the REDD+ project in the area.

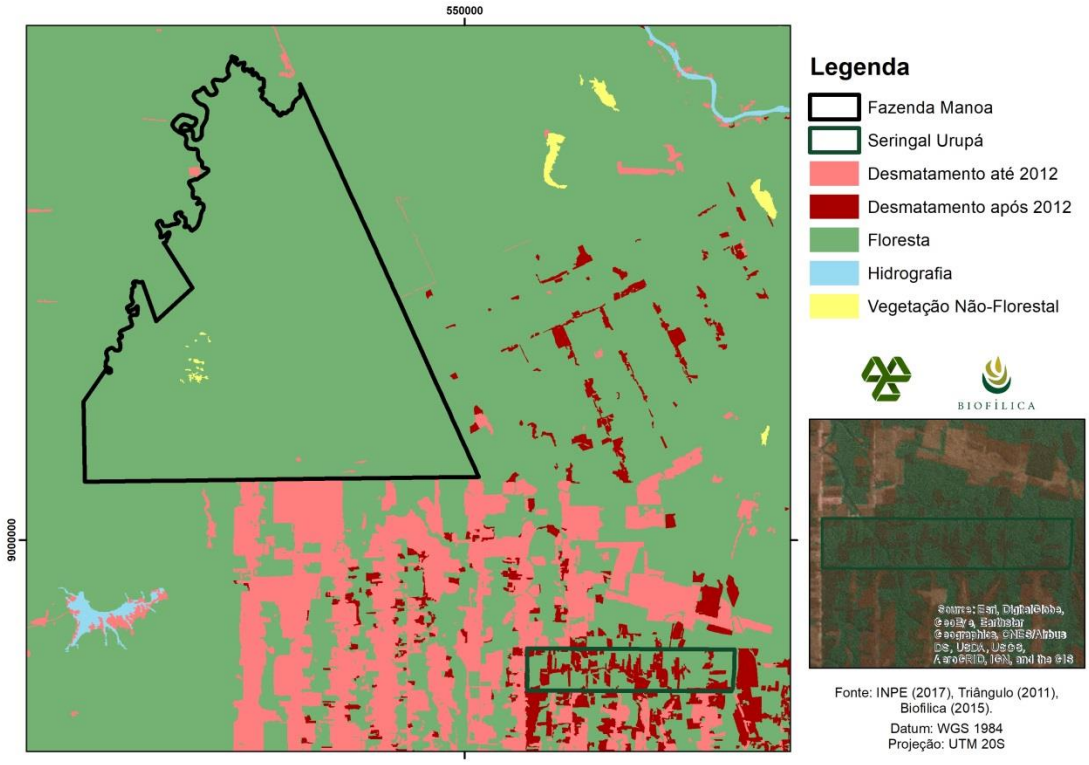


Figure 32 Deforestation occurred in the Urupá Seringal area after the end of the forest management plan.

5 QUANTIFICATION OF REDUCED GHG EMISSIONS AND REMOVALS (CLIMATE)

5.1 Project scale and GHG reduced emissions estimate or removals

Table 26 Project scale

Project	X
Megaproject	

Table 27 Estimation of reduced emissions and GHG removals.

Year of the Project t	Estimated removals and GHG emission reductions (tCO2e)
2013	50.904
2014	132.418
2015	150.485
2016	112.698
2017	230.786
2018	166.406
2019	246.298
2020	217.979
2021	248.388
2022	244.330
2023	301.007
2024	377.742
2025	309.770
2026	329.351
2027	324.113
2028	345.411
2029	355.865
2030	298.158
2031	338.505

Year of the Project t	Estimated removals and GHG emission reductions (tCO2e)
2032	349.362
2033	368.358
2034	350.578
2035	304.156
2036	271.125
2037	311.645
2038	374.893
2039	375.768
2040	263.692
2041	326.007
2042	302.499
Total	8.378.697
Total years in crediting period	30
Average Annual Reduced Emissions	279.290

5.2 Leakage management (CL2)

The description of the leakage management activities to be developed in areas already opened in the communities is described in Item 2.2. Description of project activities.

5.3 Emissions at baseline (G2)

VM0015 Step 5 - Definition of the Changes Component in the Baseline Land Use and Land Cover

Baseline activity data calculation per forest class

The results of the baseline projections pointed out approximately 22,118 hectares of deforestation in the project area between 2013 and 2042 (Table 28), and 3,734 hectares in the leakage belt (Table 29);

Table 28 Annual deforested area per forest icl inside the project area in the baseline case (VM0015 Table 11b).

Area deforested per forest class *icl* within the project area		Total baseline deforestation in the project area	
ID_{icl}>	icl1	$ABSLPA_t$	ABSLPA
Name>	Forest	annual	cumulative
Project $year_t$	ha	ha	ha
2013	198	198	198
2014	425	425	623
2015	469	469	1.092
2016	358	358	1.450
2017	674	674	2.124
2018	497	497	2.621
2019	713	713	3.334
2020	634	634	3.968
2021	715	715	4.683
2022	702	702	5.385
2023	806	806	6.191
2024	1.002	1.002	7.193
2025	826	826	8.019
2026	875	875	8.894
2027	861	861	9.755
2028	865	865	10.620
2029	890	890	11.510
2030	749	749	12.259
2031	847	847	13.106
2032	873	873	13.979
2033	919	919	14.898
2034	876	876	15.774
2035	763	763	16.537
2036	683	683	17.220
2037	782	782	18.002
2038	936	936	18.938
2039	938	938	19.876
2040	665	665	20.541
2041	817	817	21.358
2042	760	760	22.118

Table 29 Annual area deforested by forest class icl within the leakage belt in the case of baseline (table 11c of VM0015).

Area deforested per forest class *icl* within the leakage belt area		Total baseline deforestation in the Leakage belt	
ID_{icl}>	icl1	$ABSLPA_t$	ABSLPA
Name>	Forest	annual	cumulative
Project $year_t$	ha	ha	ha
2013	8	8	8
2014	108	108	116
2015	59	59	175
2016	16	16	191
2017	28	28	219
2018	47	47	266
2019	98	98	364
2020	88	88	452
2021	67	67	519
2022	86	86	605
2023	58	58	663
2024	92	92	755
2025	88	88	843
2026	138	138	981
2027	104	104	1.085
2028	134	134	1.219
2029	173	173	1.392
2030	130	130	1.522
2031	238	238	1.760
2032	162	162	1.922
2033	125	125	2.047
2034	150	150	2.197
2035	214	214	2.411
2036	269	269	2.680
2037	143	143	2.823
2038	171	171	2.994
2039	212	212	3.206
2040	199	199	3.405
2041	156	156	3.561
2042	173	173	3.734

Baseline activity data calculation per post-deforestation

Method 1 available in VM0015 Methodology was used to define the class that will replace the forest cover in the project baseline (called Anthropic Vegetation in Balance). Table 30 shows the zone 1 area, which includes the project area, leakage belt, and leakage management areas, and the corresponding area of each class of use and cover after deforestation.

Table 30 Reference region zones covering different combinations of potential post-deforestation classes.

Zone		Name		Total of all other LU/LC classes presentes in the zone		Total area of each Zone	
		Zona 1					
		ID_{fcl}	1				
IDz	Name	Area ha	% of Zone %	Area ha	% of Zone %	Area ha	% of Zone %
1	Zone 1	112,721	100	25,852	22.93	112,721	100
Total area of each class *fcl*		112,721	100	25,852	22.93%	112,721	100

Table 31 Annual deforested area in each zone within the project area in the baseline scenario (VM0015 Table 13b).

Area establiseh after deforestation per zone within the project area		Total baseline deforestation in the project area	
IDz>	1		
Name>	Zone 1	$ABSLPA_t$	ABSLPA
Project year$_t$	ha	ha	ha
2013	198	198	198
2014	425	425	623
2015	469	469	1.092
2016	358	358	1.450
2017	674	674	2.124
2018	497	497	2.621
2019	713	713	3.334
2020	634	634	3.968

2021	715	715	4.683
2022	702	702	5.385
2023	806	806	6.191
2024	1.002	1.002	7.193
2025	826	826	8.019
2026	875	875	8.894
2027	861	861	9.755
2028	865	865	10.620
2029	890	890	11.510
2030	749	749	12.259
2031	847	847	13.106
2032	873	873	13.979
2033	919	919	14.898
2034	876	876	15.774
2035	763	763	16.537
2036	683	683	17.220
2037	782	782	18.002
2038	936	936	18.938
2039	938	938	19.876
2040	665	665	20.541
2041	817	817	21.358
2042	760	760	22.118

Table 32 Annual deforested area in each zone within the leakage belt in the baseline scenario (VM0015 Table 13c).

Area establiseh after deforestation per zone within the leakage belt		Total baseline deforestation in the leakage belt	
IDz>	1		
Name>	Zone 1	$ABSLLK_t$	ABSLLK
Project year$_t$	ha	ha	ha
2013	8	8	8
2014	108	108	116
2015	59	59	175
2016	16	16	191
2017	28	28	219
2018	47	47	266
2019	98	98	364
2020	88	88	452
2021	67	67	519
2022	86	86	605
2023	58	58	663
2024	92	92	755
2025	88	88	843
2026	138	138	981
2027	104	104	1.085
2028	134	134	1.219
2029	173	173	1.392
2030	130	130	1.522
2031	238	238	1.760
2032	162	162	1.922
2033	125	125	2.047
2034	150	150	2.197
2035	214	214	2.411
2036	269	269	2.680
2037	143	143	2.823
2038	171	171	2.994
2039	212	212	3.206
2040	199	199	3.405
2041	156	156	3.561
2042	173	173	3.734

Calculation of activity data by change category in land use and land cover

Not applicable.

VM0015 Step 6 - Estimate in Carbon Stock and non-CO2 Emissions Changes in the Baseline

The estimate of carbon stock for Forest class was obtained through a primary forest inventory conducted in 2015 by Florestal-Planejamento, Paisagismo e Consultoria Ltda. technical staff, in partnership with Biofílica Investimentos Ambientais. The main results obtained in this study are described below. Further information can be found in the the Carbon Stock Final Report (Florestal-Planejamento, Paisagismo e Consultoria Ltda, 2015).

Estimate of carbon average stock by class of use and change in land cover

The forest inventory in Manoa Farm was conducting applying the sampling technique, which uses concepts or statistical theory to estimate the uncertainties (errors) of a population that presents normal distribution. Thus, a Cluster sampling was applied, due to the simplicity of planning, costs, and administration, including data to estimate biomass carbon stock above and below ground.

The Clusters were arranged in Maltese cross shape, consisting of four rectangular sub-units (10 x 250 m) oriented toward the cardinal points, and numbered from 1 to 4, 50 meters apart from the cluster center (Figure 33). The sampling was conducted in the two most representative forest extracts in the area (Lowland Open Ombrophilous Forest and Submontane Open Ombrophilous Forest), and these were divided between explored and unexplored area. Data from live plant with Diameter at Breast Height (DBH) greater than 10 cm or Circumference at Breast Height (CBH) greater than 31 cm.

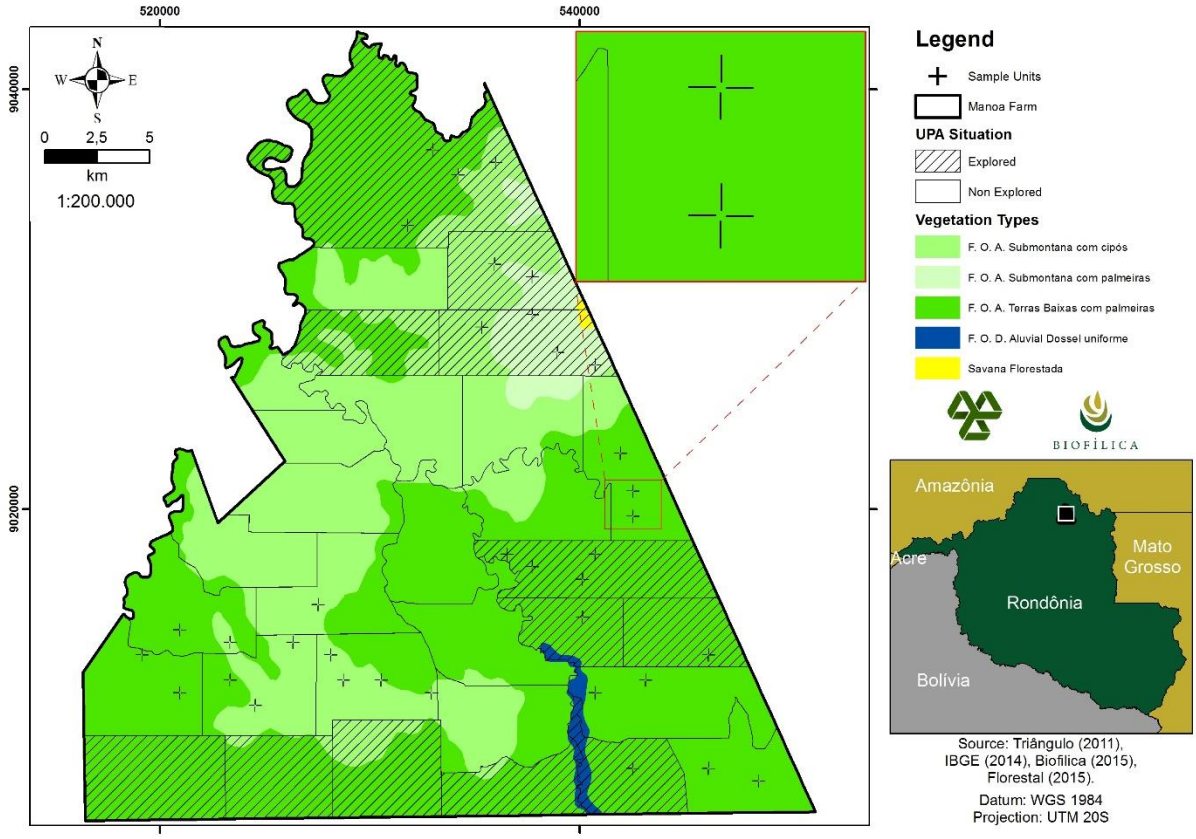


Figure 33 Allocation of forest inventory ample units in the project area.

Estimated variables

Number of Individuals

The number of individuals per hectare was estimated by extrapolating the number of individuals measured in the parcel (trees, palm trees, and vines) through the relation below:

$$N = n \times 1/a$$

Once:

N = Number of individuals per hectare;

n = Number of individuals in the sample;

a = Plot area (0.25 ha)

Basal Area

The basal area is a population density measurement, and reflects the individuals occupation degree within a certain forest area. This is a forest population density measure, which makes it a very important estimate in the decision-making.

Biomass and Carbon

Above-ground biomass

Concerning trees, the data input unit was DBH, used to determine the biomass and carbon storage. Data from palm trees and vines were not used in the carbon stock calculation, only for phytosociological analysis. The biomass contained in the trees were quantified applying the allometric equation described by Nogueira (2008), which was more suitable for the study area. Below is the description of the equation:

$$DW_{abg} = EXP\ (-1{,}716 + 2{,}413 \times \ln (DBH))$$

Once:

DWabg = Dry weight above ground estimated for each individual;

DBH = diameter at breast height or just above the buttresses;

Bellow-ground biomass (roots)

The tree roots biomass was estimated applying an equation proposed by Silva (2007), adjusted based on data collected in the field, which is the only one data available in literature for the Amazon Rainforest. Below is the description of the equation:

$$FW_{Root} = 0{,}0469 \times DBH^{2{,}4754}$$

Once:

FW_{root} = Root Fresh Weight estimated for each individual

DHB = diameter at Breast Height

In this equation, the diameter is related to fresh mass, so a conversion factor was used to obtain the Dry Weight considering the average moisture content of thick and thin roots (46.7%), described by Smith (2007). Thus, the Dry Weight is calculated by the following equation:

$$FW_{Root} = FW_{Root} \times 0,533$$

Once:

FW_{root} = Fresh Weight of root estimated for each individual.

FW_{root} = Root Dry Weight estimated for each individual

Carbon Content

The estimated carbon stocks will be obtained through the carbon content determined by Silva (2007), who showed that the carbon content is 48.5% of the dry weight found for each individual. Therefore, the following equation is used:

$$C_{AS} = DW\ (abg + blg) \times 0.485$$

as:

C = Carbon $_{AS}$ Above Ground;

DW = estimated Dry Weight for each individual (above and below ground).

Sampling

36 clusters were installed, distributed in 4 strata defined at Manoa Farm area. Each cluster contains 4 sampling units, totaling 144 samples. A total of 19,575 individuals were inventoried, of which 18,471 were trees (94.4%), 375 vine (1.9%), and 1,329 palm trees (6.8%).

Out of the 18,471 inventoried trees, 12 individuals showed DBH higher than 124 cm, which were lowered to 124cm for biomass calculations, as conservative measure. The application range of the equation proposed by Nogueira (2008), described above, ranges from 5 to 124 cm DBH.

Analysis of Variance

An analysis of variance (ANOVA) was carried out to evaluate the significance of the variation between the averages in the carbon stock for the forest typologies found in the managed and unmanaged areas in the Project Area. In this analysis, the value of P found was higher than 5% with 95% confidence interval, so it is possible to assume that the averages are equal in both cases, that is, no statistical differences between the averages of forest typologies in the project.

Table 33 Analysis of Variance among forest typologies in managed areas.

Variation Source	*SQ*	*gl*	*MQ*	*F*	*P-value*	*Critical F*
Among groups	142,6881836	1	142,6882	2,0401	0,1574	3,9702
Inside the groups	5175,777155	74	69,9429			
Total	**5318,465339**	**75**				

Table 34 Analysis of Variance among forest types in unmanaged areas.

Variation Source	*SQ*	*gl*	*MQ*	*F*	*P-value*	*Critical F*
Among groups	55,92024706	1	55,9202	0,4125	0,5229	3,9863
Inside the groups	8947,751411	66	135,5720			
Total	**9003,671658**	**67**				

Individuals Number

Table 35 presents the number of individuals per hectare inventoried in the 36 conglomerates installed. In total, 539 ind/ha were inventory in the managed area and 549 ind/ha in the unmanaged area (trees, palms and vines). The average stock of tree individuals with DBH≥10cm was 512 ind/ha (± 19.1) in the managed area and 515 ind / ha (± 32.3) for the unmanaged area. In general, the number of arboreal individuals was 513 ind/ha (± 26.2), considering the weighted calculations.

In the managed area, the lianas represented 1.7% of the individuals and the palm trees represented 3.4%. In the unmanaged area, the vines represented 2.2% and the palm trees represented 4.1%.

Table 35 Number of individuals per hectare, distributed among Trees, vines and Palms.

Stratum	Nº of individuals/ha							
	Trees	CI	%	Vines	%	Pams	%	Total
Managed Area	512	± 19,1	94,9%	9,1	1,7%	18,5	3,4%	539
Unmanaged Area	515	± 32,3	93,8%	11,9	2,2%	22,2	4,1%	549
Total	**513**	**± 26,2**	**94,3%**	**10,6**	**1,9%**	**20,5**	**3,8%**	**544**

Basal Area

In general, the basal area per hectare (considering trees, palms and vines) was 24.67 m²/ha. In the managed area, it was 23.15 m²/ha and in the unmanaged area 25.97 m²/ha. The living arboreal individuals presented an estimated occupancy area of 22.35 m²/ha in the managed area and 25.18 m²/ha in the unmanaged area. In general, they presented 23.88 m²/ha of occupation, considering the weighted calculations.

Table 36 Basal area (m²/ha), distributed among Trees, vines and Palms.

Stratum	Basal Area m²/ha							
	Trees	CI	%	Vines	%	Palms	%	Total
Managed Area	22,35	± 1,34	96,6%	0,16	0,7%	0,64	2,8%	23,15
Unmanaged Area	25,18	± 2,05	96,9%	0,17	0,7%	0,63	2,4%	25,97
Total	**23,88**	**± 1,73**	**96,8%**	**0,16**	**0,7%**	**0,63**	**2,6%**	**24,67**

Carbon Stock

The carbon estimate calculated for stock above and below ground, considering the mean values calculated for managed forest and primary forest, was 119.01 tC/ha (± 9.95 t.C/ha) for the reservoir above ground and 20.89 tC/ha (± 1.79 t.C/ha) to the reservoir below soil. The area presented 139.89 tC/ha (± 11,74 t.C/ha).

The carbon content values found in this study (unmanaged area) are consistent with very conservative estimates found in Open Forests in Rondônia, by Nogueira (2008), which were 153.75

tC/ha. It is also very close to the value found in the inventory held at Sete de Setembro Indian village, territory of Paiter-Suruí indigenous tribe, which was 125.97 tC/ha, compared to above-ground biomass.

Emission Reduction Calculation

The reduced emissions was calculated multiplying the inventory estimated stock by 3.6667, as 1 kg of C is equal to 3.66667 (44/12) kg of CO2 (CO2 mass = 44 and C mass = 12; 44/12 = 3.66667). Table 37 shows the average carbon values per hectare for each initial class of land use and land cover considered for the baseline scenario present in the project area and leakage belt.

Table 37 Carbon stocks per hectare for icl initial class existing in the project area and leakage belt (VM0015 Table 15a).

Initial forest class *icl*							
Name:	Forest						
ID_{icl}	1						
Average carbon stock per hectare + 90% CI							
Cab_{icl}		Cbb_{icl}		Cdw_{icl}		$Ctot_{icl}$	
C stock $tCO_2e\ ha^{-1}$	± 95% CI $tCO_2e\ ha^{-1}$	C stock $tCO_2e\ ha^{-1}$	± 95% CI $tCO_2e\ ha^{-1}$	C stock $tCO_2e\ ha^{-1}$	± 95% CI $tCO_2e\ ha^{-1}$	C stock $tCO_2e\ ha^{-1}$	± 95% CI $tCO_2e\ ha^{-1}$
436,4	10,0	76,6	1,8	-	-	513,0	11,7

Once:

Cab $_{icl}$ = average equivalent carbon stock per hectare for biomass reservoir above ground for the forest initial class;

Cbb $_{icl}$ = stock average carbon equivalent per hectare for the biomass reservoir below ground biomass for the forest initial class;

Cdw_{icl} = stock average carbon equivalent per hectare for the dead biomass reservoir biomass for the forest initial class;

Ctot $_{icl}$ = average equivalent carbon stock per hectare for total biomass reservoir for the forest initial class;

Post-deforestation classes projected for the project area and leakage belt in the baseline scenario and existing non-forest classes in the leakage management area:

The VM0015 Methodology allows the use of estimates based on local studies; thus, an amount of 64.6 tCO2e ha-1 was taken as a reference for the carbon stock of the anthropic vegetation in balance class, which is the class projected to exist in the project area and leakage belt in the project scenario. This carbon stock estimate was obtained from (WANDERLLI & FEARNSIDE, 2015), through a long-term study on the landscape and vegetation average composition in deforested areas of the Brazilian Amazon, which consists of a matrix composed of pastures, small-scale agriculture, and secondary vegetation, usually found in a post-deforestation scenario in the Amazon.

Wanderlli & Fearnside (2015) is a reviewed scientific literature, and it Represents one of the most current studies for the Brazilian Amazon concerning carbon stock in deforested areas, complying with section 4.5.6 of the VCS Standards:

1. The data were not collected directly from primary sources;
2. The data were collected from secondary sources, by INPA (renowned research institute for the topic in Brazil), published by an international and renowned scientific journal (Forest Ecology and Management, 2015);
3. The data are from a period that accurately defines the current practices available for determination of carbon stock;
4. No sample was applied on these data;
5. The data is available to the public through the website: http://www.ppginpa.eco.br/documents/teses_dissertacoes/wandelli-fearnside-2015-for-ecol-man_Land-use-history-and-capoeira-growth.pdf. Accessed on July 18, 2017;
6. Available for independent evaluation of VCSA and VVB;
7. The data are appropriate for VM0015 geographic scope;
8. The expert analysis was not necessary; and
9. The data are not only kept in one central repository storage only.

Calculation of change factors in carbon stock

The project baseline scenario considers the changes in carbon stock of a replaced by a type of vegetation that can be pasture areas, small-scale crops, or temporary and permanent crops. AFOLU VCS

requests to account the decay of carbon stocks in organic soil carbon reservoirs, of below-ground biomass, dead wood, and wood products.

The decay is calculated through VM0015 version 1.1, which applies a linear function to account the initial carbon stock decay initial carbon to the initial for the initial forest class (icl), and a carbon stock increase in the class after deforestation (fcl). Table 20a (Table 38) And Table 20b (Table 39) show how the carbon stock change factor was calculated.

Table 38 Carbon stock change factor for the initial forest class icl (Method 1) (VM0015 Table 20a).

Year after deforestation		$\Delta Cab_{icl,t}$	$\Delta Cbb_{icl,t}$	$\Delta Cdw_{icl,t}$	$\Delta Ctot_{cl,t}$
1	t*	436,4	7,7	0,0	444,0
2	t*+1	0	7,7	0,0	7,7
3	t*+2	0	7,7	0,0	7,7
4	t*+3	0	7,7	0,0	7,7
5	t*+4	0	7,7	0,0	7,7
6	t*+5	0	7,7	0,0	7,7
7	t*+6	0	7,7	0,0	7,7
8	t*+7	0	7,7	0,0	7,7
9	t*+8	0	7,7	0,0	7,7
10	t*+9	0	7,7	0,0	7,7
11	t*+10				
12	t*+11				
13	t*+12				
14	t*+13				
15	t*+14				
16	t*+15				
17	t*+16				
18	t*+17				
19	t*+18				
20	t*+19				
21-T	t*+20...				

Table 39 Carbon stock change factor for fcl class or z zones (Method 1) (VM0015 Table 20b).

Year after deforestation		$\Delta Ctot_{fcl,t}$
1	t*	6,5
2	t*+1	6,5
3	t*+2	6,5
4	t*+3	6,5
5	t*+4	6,5
6	t*+5	6,5
7	t*+6	6,5
8	t*+7	6,5
9	t*+8	6,5
10	t*+9	6,5
11	t*+10	0
12	t*+11	0
13	t*+12	0
14	t*+13	0
15	t*+14	0
16	t*+15	0
17	t*+16	0
18	t*+17	0
19	t*+18	0
20	t*+19	0
21-T	t*+20...	

Baseline calculation of changes in carbon stock

VM0015 version 1.1 Method 1 (activity data are available for classes) was used to calculate the carbon stock change baseline in the project area (Table 40), and in the leakage belt (

Table 41) for year t, according to equation 10, page 72 of VM0015 version 1.1.

Table 40 Carbon stock changes baseline in the project area.

Carbon stock changes per initial forest class *icl*		Total carbon stock change of initial forest class in the project area	Carbon stock changes per post-deforestation zone z	Total carbon stock change of post-deforestation zones in the project area	Total net carbon stock change of the project area	
ID_{icl}>	1	$\Delta CBSLPA_{icl}$	1	$\Delta CBSLPA_z$	$\Delta CBSLPA_t$	$\Delta CBSLPA$
Name>	Forest	cumulative	Zone 1	cumulative	annual	cumulative
Project Year *t*	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2013	87.917,9	87.917,9	1.279,5	1.279,5	86.638,4	86.638,4
2014	190.229,2	278.147,1	4.025,9	5.305,4	186.203,4	272.841,7
2015	213.021,9	491.169,0	7.056,6	12.361,9	205.965,3	478.807,1
2016	167.327,0	658.496,0	9.370,0	21.731,9	157.957,0	636.764,1
2017	310.382,5	968.878,5	13.725,4	35.457,3	296.657,1	933.421,1
2018	236.951,9	1.205.830,3	16.937,1	52.394,4	220.014,8	1.153.436,0
2019	336.669,1	1.542.499,5	21.544,5	73.938,9	315.124,6	1.468.560,6
2020	307.052,1	1.849.551,6	25.641,5	99.580,3	281.410,7	1.749.971,3
2021	347.874,8	2.197.426,4	30.261,8	129.842,2	317.612,9	2.067.584,2
2022	347.579,0	2.545.005,4	34.798,2	164.640,4	312.780,9	2.380.365,1
2023	397.618,6	2.942.624,0	38.727,1	203.367,5	358.891,5	2.739.256,5
2024	487.566,8	3.430.190,8	42.455,7	245.823,2	445.111,0	3.184.367,6
2025	413.500,1	3.843.690,9	44.762,7	290.585,9	368.737,4	3.553.105,0
2026	438.842,3	4.282.533,2	48.103,6	338.689,5	390.738,7	3.943.843,7
2027	434.165,5	4.716.698,7	49.312,0	388.001,5	384.853,5	4.328.697,2
2028	438.729,7	5.155.428,4	51.690,0	439.691,5	387.039,7	4.715.737,0
2029	450.994,7	5.606.423,2	52.833,8	492.525,3	398.160,9	5.113.897,9
2030	390.347,4	5.996.770,6	53.576,9	546.102,2	336.770,5	5.450.668,4
2031	434.122,8	6.430.893,4	54.429,9	600.532,2	379.692,8	5.830.361,2

2032	446.778,2	6.877.671,5	55.534,9	656.067,1	391.243,2	6.221.604,4
2033	467.716,7	7.345.388,3	56.265,2	712.332,3	411.451,6	6.633.056,0
2034	447.987,7	7.793.376,0	55.450,9	767.783,2	392.536,8	7.025.592,8
2035	398.195,4	8.191.571,4	55.043,8	822.827,0	343.151,5	7.368.744,3
2036	361.815,1	8.553.386,5	53.803,1	876.630,1	308.012,0	7.676.756,3
2037	404.410,6	8.957.797,1	53.292,6	929.922,7	351.118,0	8.027.874,3
2038	472.155,4	9.429.952,5	53.751,4	983.674,2	418.404,0	8.446.278,3
2039	473.395,8	9.903.348,3	54.061,6	1.037.735,8	419.334,2	8.865.612,6
2040	353.623,4	10.256.971,7	53.518,8	1.091.254,5	300.104,6	9.165.717,2
2041	419.721,9	10.676.693,6	53.324,9	1.144.579,5	366.396,9	9.532.114,1
2042	393.983,2	11.070.676,8	52.594,7	1.197.174,2	341.388,5	9.873.502,7

Table 41 Carbon stock changes baseline in the leakage belt.

Carbon stock changes per initial forest class *icl*		Total carbon stock change of initial forest class in the leakage belt area	Carbon stock changes per post-deforestation zone z	Total carbon stock change of post-deforestation zones in leakage belt area	Total net carbon stock change of the leakage belt area	
ID_{icl}>	1	$\Delta CBSLLK_{icl}$	1	$\Delta CBSLLK_z$	$\Delta CBSLLK_t$	$\Delta CBSLLK$
Name>	Forest	cumulative	Zone 1	cumulative	annual	cumulative
Project Year *t*	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2013	3.552,2	3.552,2	51,7	51,7	3.500,5	3.500,5
2014	48.016,5	51.568,7	749,6	801,3	47.266,9	50.767,4
2015	27.086,3	78.655,0	1.130,9	1.932,2	25.955,4	76.722,8
2016	8.444,9	87.099,9	1.234,3	3.166,4	7.210,7	83.933,5
2017	13.895,8	100.995,7	1.415,2	4.581,6	12.480,6	96.414,1
2018	22.546,9	123.542,6	1.718,9	6.300,5	20.828,0	117.242,1
2019	45.552,4	169.095,0	2.352,2	8.652,7	43.200,2	160.442,3
2020	41.862,7	210.957,7	2.920,9	11.573,5	38.941,9	199.384,2
2021	33.212,2	244.169,9	3.353,8	14.927,4	29.858,3	229.242,5
2022	42.161,9	286.331,8	3.909,5	18.836,9	38.252,4	267.494,9
2023	30.326,5	316.658,3	4.232,6	23.069,6	26.093,9	293.588,8
2024	45.040,6	361.698,9	4.129,3	27.198,8	40.911,3	334.500,1

2025	43.517,2	405.216,1	4.316,7	31.515,5	39.200,6	373.700,6
2026	66.270,2	471.486,3	5.105,0	36.620,5	61.165,2	434.865,8
2027	52.015,8	523.502,1	5.596,1	42.216,6	46.419,6	481.285,4
2028	65.773,2	589.275,3	6.158,3	48.375,0	59.614,9	540.900,3
2029	83.366,1	672.641,4	6.643,0	55.018,0	76.723,1	617.623,5
2030	64.923,9	737.565,4	6.914,4	61.932,4	58.009,5	675.633,0
2031	113.361,7	850.927,1	8.019,4	69.951,8	105.342,3	780.975,3
2032	80.779,7	931.706,8	8.510,5	78.462,3	72.269,2	853.244,5
2033	65.147,2	996.854,0	8.943,5	87.405,8	56.203,7	909.448,2
2034	76.500,7	1.073.354,8	9.318,3	96.724,1	67.182,4	976.630,7
2035	105.393,5	1.178.748,3	10.132,5	106.856,6	95.261,0	1.071.891,7
2036	130.397,3	1.309.145,6	10.979,0	117.835,7	119.418,3	1.191.310,0
2037	75.713,4	1.384.859,0	11.231,1	129.066,7	64.482,4	1.255.792,3
2038	88.215,2	1.473.074,2	11.470,2	140.536,9	76.745,0	1.332.537,3
2039	106.405,1	1.579.479,3	11.722,2	152.259,1	94.682,9	1.427.220,2
2040	101.260,8	1.680.740,1	12.168,1	164.427,1	89.092,7	1.516.313,0
2041	81.868,8	1.762.608,8	11.638,2	176.065,3	70.230,6	1.586.543,6
2042	89.371,3	1.851.980,2	11.709,3	187.774,5	77.662,1	1.664.205,6

Non-CO2 emissions baseline per forest fires

Non-CO2 emissions were not considered and accounted for the project

5.4 Project emissions (CL1)

(VM0015 Step 7) Ex-ante Estimate of Real Changes in Carbon Stock and Non-CO2 Emissions in the Project Area

Non-CO2 emissions were not considered and accounted for the project

(VM0015 Step 7) Ex-ante estimate of real changes in carbon stock

(VM0015 Step 7) Ex-ante estimate of real changes in carbon stock due to planned activities

Low impact logging activities are expected to take place in the Project area, developed by the logging company Indústria de Madeiras Manoa Ltda, which follows FSC principles and criteria, not leaving large clearings in the forest. As observed by Holmes et al. (2002), in forest exploration systems of reduced impact, such as FSC Management, less than 10% of dragging trails can cause exposure of the soil and, consequently, clearings in the forest canopy.

In the case of the Project, a carbon stock reduction was estimated concerning deforestation for implementation of infrastructure, for example, new roads, or forest patios in each annual production unity (UPA) within the project area. This estimate was based on the post-exploratory reports of the Manoa farm, in which an average of 1.6% of the open area was adopted in the UPAs for infrastructures in the management activity. Table 42 shows the planned deforestation estimated area and the impact on carbon stocks in the project area. Figure 34 shows the location of each UPA in the Manoa REDD+ Project.

Table 42 Ex-ante estimate on stock reduction due to planed deforestation in the Project Area (VM0015 Methodology Table 25a).

Project Year *t*	Areas of planned deforestation x Carbon stock change (decrease) in the project area		Total carbon stock decrease due to planned deforestation	
	ID_{cl} =	1	annual	cummulative
	$APDPA_{icl,t}$	$Ctot_{icl,t}$	$\Delta CPDdPA_t$	$\Delta CPDdPA$
	ha	tCO_2e ha^{-1}	tCO_2e	tCO_2e
2013	35,9	513,0	18.405,1	18.405,1
2014	35,9	513,0	18.405,1	36.810,2
2015	35,9	513,0	18.405,1	55.215,4
2016	35,9	513,0	18.405,1	73.620,5
2017	35,9	513,0	18.405,1	92.025,6
2018	35,9	513,0	18.405,1	110.430,7
2019	35,9	513,0	18.405,1	128.835,9
2020	35,9	513,0	18.405,1	147.241,0
2021	35,9	513,0	18.405,1	165.646,1
2022	35,9	513,0	18.405,1	184.051,2
2023	35,9	513,0	18.405,1	202.456,3
2024	35,9	513,0	18.405,1	220.861,5
2025	35,9	513,0	18.405,1	239.266,6
2026	35,9	513,0	18.405,1	257.671,7
2027	35,9	513,0	18.405,1	276.076,8
2028	35,9	513,0	18.405,1	294.482,0
2029	35,9	513,0	18.405,1	312.887,1
2030	35,9	513,0	18.405,1	331.292,2
2031	35,9	513,0	18.405,1	349.697,3
2032	35,9	513,0	18.405,1	368.102,5
2033	35,9	513,0	18.405,1	386.507,6
2034	35,9	513,0	18.405,1	404.912,7
2035	35,9	513,0	18.405,1	423.317,8
2036	35,9	513,0	18.405,1	441.722,9
2037	35,9	513,0	18.405,1	460.128,1
2038	35,9	513,0	18.405,1	478.533,2
2039	35,9	513,0	18.405,1	496.938,3
2040	35,9	513,0	18.405,1	515.343,4
2041	35,9	513,0	18.405,1	533.748,6
2042	35,9	513,0	18.405,1	552.153,7

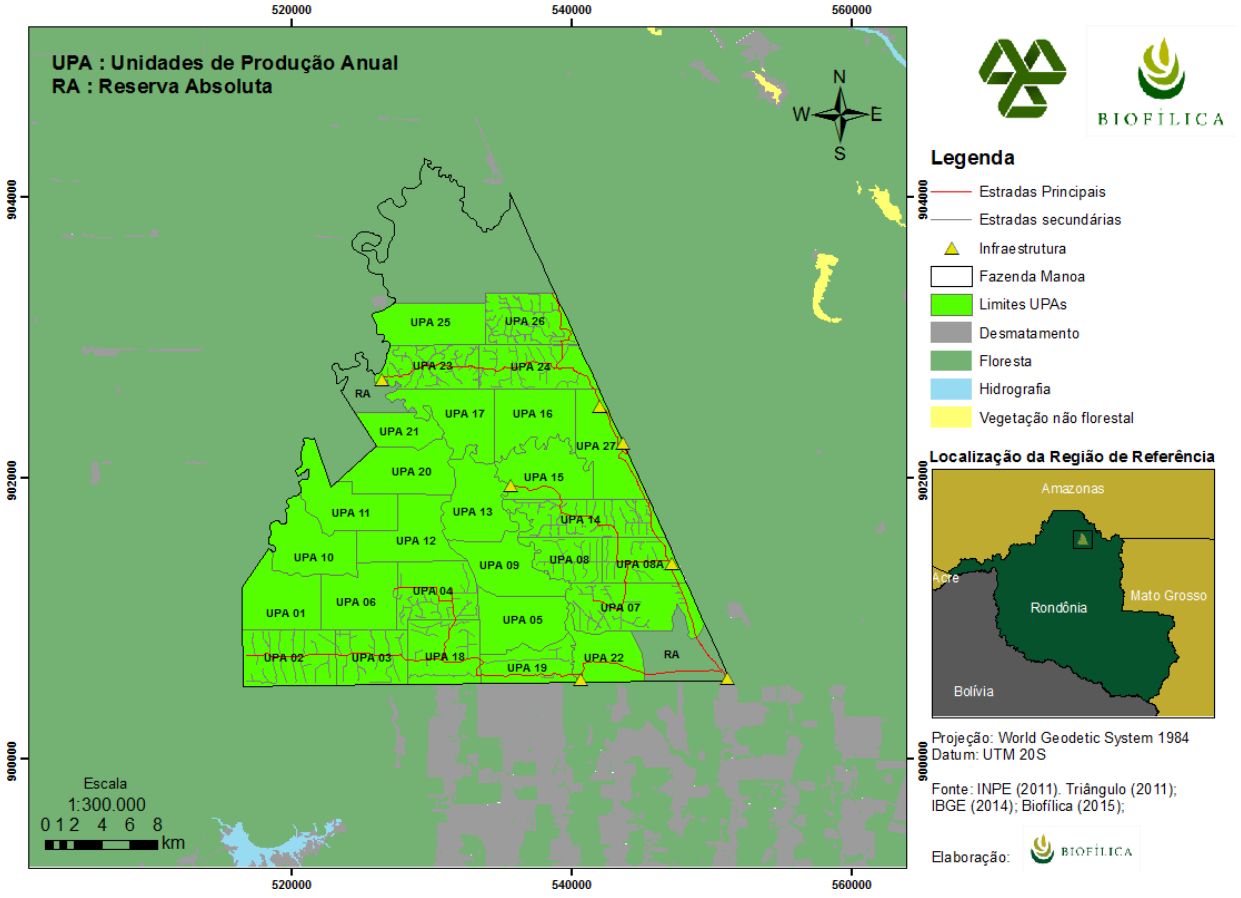


Figure 34 Location of areas subject to planned deforestation to implement FSC management infrastructure.

Wood Extraction

The forest management activities planned by Indústria de Madeiras Manoa Ltda. will be monitored and reported on each project verification event, this monitoring will be based on Post-exploring Reports.

In this sense, a significance analysis was performed based on the "Tool for testing significance of GHG emissions in A/R CDM project activities" tool to evaluate the impact of the emissions of the logging activity on the project emissions. For the calculation, data provided by Manoa were used for the annual intensity of forest exploitation and the amount of carbon extracted, since the average annual volume of extracted carbon calculated for the Manoa farm management was 130,516 tCO2e. The potential of carbon increment in the managed forest was also considered, and according to West et al. (2013), an

area managed in the reduced impact system regenerates about 2.8 tons of above ground biomass per hectare per year (4.89 tCO2e/ha.year). Thus, the calculated balance of carbon stock changes due to timber activity was 13,838 tCO2e per year.

For the significance assessment, the relationship between the balance of carbon stock changes due to the logging activity and the total baseline emissions was applied. The results showed that the emissions related to the logging activity are below the threshold of 5% of significance required by the Standard and therefore can be disregarded of the scope of project emissions.

All calculations related to the significance test were shared with the audit team. In case of reduction in carbon stock due to logging, VM0015 Table 25b will be filled ex-post.

The construction of infrastructure for forest management activities, such as patios and roads, will be considered as planned deforestation in the project area. Moreover, according to VM0015 footnote number 85, carbon stock from forest management products with the purpose to constitute durable wooden goods may be conservatively ignored in the project scenario.

Production of charcoal and firewood collection

The production of charcoal or firewood collection is not expected. This type of use was not identified among families during the social diagnosis. In case of carbon stock reduction in the forest due to this activity, Table 25b and Table 25c of VM0015 will be presented ex post. Table 43 shows ex ante estimate of carbon stock reduction due to activities planned by the project.

Table 43 Ex-ante estimate on stock reduction due to planed deforestation in the Project Area (VM0015 Methodology Table 25d).

Project Year t	Total carbon stock decrease due to planned deforestation		Total carbon stock decrease due to planned logging activities		Total carbon stock decrease due to planned fuel-wood and charcoal activities		Total carbon stock decrease due to planned activities	
	annual $\Delta CPDdPA_t$ tCO_2e	cumulative $\Delta CPDdPA$ tCO_2e	annual $\Delta CPLdPA_t$ tCO_2e	cumulative $\Delta CPLdPA$ tCO_2e	annual $\Delta CPFdPA_t$ tCO_2e	cumulative $\Delta CPFdPA$ tCO_2e	annual $\Delta CPAdPA_t$ tCO_2e	cumulative $\Delta CPAdPA$ tCO_2e
2013	18.405,1	18.405,1	0,0	0,0	0,0	0,0	18.405,1	18.405,1
2014	18.405,1	36.810,2	0,0	0,0	0,0	0,0	18.405,1	36.810,2
2015	18.405,1	55.215,4	0,0	0,0	0,0	0,0	18.405,1	55.215,4
2016	18.405,1	73.620,5	0,0	0,0	0,0	0,0	18.405,1	73.620,5
2017	18.405,1	92.025,6	0,0	0,0	0,0	0,0	18.405,1	92.025,6
2018	18.405,1	110.430,7	0,0	0,0	0,0	0,0	18.405,1	110.430,7
2019	18.405,1	128.835,9	0,0	0,0	0,0	0,0	18.405,1	128.835,9
2020	18.405,1	147.241,0	0,0	0,0	0,0	0,0	18.405,1	147.241,0
2021	18.405,1	165.646,1	0,0	0,0	0,0	0,0	18.405,1	165.646,1
2022	18.405,1	184.051,2	0,0	0,0	0,0	0,0	18.405,1	184.051,2
2023	18.405,1	202.456,3	0,0	0,0	0,0	0,0	18.405,1	202.456,3
2024	18.405,1	220.861,5	0,0	0,0	0,0	0,0	18.405,1	220.861,5
2025	18.405,1	239.266,6	0,0	0,0	0,0	0,0	18.405,1	239.266,6
2026	18.405,1	257.671,7	0,0	0,0	0,0	0,0	18.405,1	257.671,7
2027	18.405,1	276.076,8	0,0	0,0	0,0	0,0	18.405,1	276.076,8
2028	18.405,1	294.482,0	0,0	0,0	0,0	0,0	18.405,1	294.482,0
2029	18.405,1	312.887,1	0,0	0,0	0,0	0,0	18.405,1	312.887,1
2030	18.405,1	331.292,2	0,0	0,0	0,0	0,0	18.405,1	331.292,2
2031	18.405,1	349.697,3	0,0	0,0	0,0	0,0	18.405,1	349.697,3
2032	18.405,1	368.102,5	0,0	0,0	0,0	0,0	18.405,1	368.102,5
2033	18.405,1	386.507,6	0,0	0,0	0,0	0,0	18.405,1	386.507,6
2034	18.405,1	404.912,7	0,0	0,0	0,0	0,0	18.405,1	404.912,7
2035	18.405,1	423.317,8	0,0	0,0	0,0	0,0	18.405,1	423.317,8
2036	18.405,1	441.722,9	0,0	0,0	0,0	0,0	18.405,1	441.722,9
2037	18.405,1	460.128,1	0,0	0,0	0,0	0,0	18.405,1	460.128,1
2038	18.405,1	478.533,2	0,0	0,0	0,0	0,0	18.405,1	478.533,2
2039	18.405,1	496.938,3	0,0	0,0	0,0	0,0	18.405,1	496.938,3
2040	18.405,1	515.343,4	0,0	0,0	0,0	0,0	18.405,1	515.343,4
2041	18.405,1	533.748,6	0,0	0,0	0,0	0,0	18.405,1	533.748,6
2042	18.405,1	552.153,7	0,0	0,0	0,0	0,0	18.405,1	552.153,7

Optional counting of carbon stocks increase

The ex-ante estimate of carbon stock increase due to regeneration after management activities was not considered for conservative measure.

Ex-ante estimate of carbon stock changes due to inevitable unplanned deforestation in the project area

The project activities can reduce about 95% of baseline emissions in the first year of the project and, after the first few years of implementation it may reach 99%. After this period, considering an effective monitoring of the forest cover and continuity of the strong governance carried out in the area by the management, strengthened by the activities of the project, it is expected that the project Effectiveness Index remains close to 100% in all foreseen years of reduced emissions accounting (30 years after 2010).

Ex-ante estimate of net real changes in carbon stock in the project area

Table 44 shows the carbon stock changes related to planned activities and the project effectiveness.

Table 44 Ex-ante estimates of net carbon reduction in the project area on the project scenario (VM0015 Table 27).

Project Year t	Total carbon stock decrease due to planned activities		Total carbon stock increase due to planned activities		Total carbon stock decrease due to unavoided unplanned deforestation		Total carbon stock change in the project case	
	annual $\Delta CPAdPA_t$ tCO_2e	cumulative $\Delta CPAdPA$ tCO_2e	annual $\Delta CPAiPA_t$ tCO_2e	cumulative $\Delta CPAiPA$ tCO_2e	annual $\Delta CUDdPA_t$ tCO_2e	cumulative $\Delta CUDdPA$ tCO_2e	annual $\Delta CPSPA_t$ tCO_2e	cumulative $\Delta CPSPA$ tCO_2e
2013	18.405,1	18.405,1	0,0	0,0	4.331,9	4.331,9	22.737,0	22.737,0
2014	18.405,1	36.810,2	0,0	0,0	7.448,1	11.780,1	25.853,3	48.590,3
2015	18.405,1	55.215,4	0,0	0,0	6.179,0	17.959,0	24.584,1	73.174,4
2016	18.405,1	73.620,5	0,0	0,0	3.159,1	21.118,2	21.564,3	94.738,6
2017	18.405,1	92.025,6	0,0	0,0	2.966,6	24.084,7	21.371,7	116.110,3
2018	18.405,1	110.430,7	0,0	0,0	2.200,1	26.284,9	20.605,3	136.715,6
2019	18.405,1	128.835,9	0,0	0,0	3.151,2	29.436,1	21.556,4	158.272,0
2020	18.405,1	147.241,0	0,0	0,0	2.814,1	32.250,2	21.219,2	179.491,2
2021	18.405,1	165.646,1	0,0	0,0	3.176,1	35.426,4	21.581,3	201.072,5
2022	18.405,1	184.051,2	0,0	0,0	3.127,8	38.554,2	21.532,9	222.605,4
2023	18.405,1	202.456,3	0,0	0,0	3.588,9	42.143,1	21.994,0	244.599,4

2024	18.405,1	220.861,5	0,0	0,0	4.451,1	46.594,2	22.856,2	267.455,7
2025	18.405,1	239.266,6	0,0	0,0	3.687,4	50.281,6	22.092,5	289.548,2
2026	18.405,1	257.671,7	0,0	0,0	3.907,4	54.188,9	22.312,5	311.860,7
2027	18.405,1	276.076,8	0,0	0,0	3.848,5	58.037,5	22.253,7	334.114,3
2028	18.405,1	294.482,0	0,0	0,0	3.870,4	61.907,9	22.275,5	356.389,8
2029	18.405,1	312.887,1	0,0	0,0	3.981,6	65.889,5	22.386,7	378.776,6
2030	18.405,1	331.292,2	0,0	0,0	3.367,7	69.257,2	21.772,8	400.549,4
2031	18.405,1	349.697,3	0,0	0,0	3.796,9	73.054,1	22.202,1	422.751,5
2032	18.405,1	368.102,5	0,0	0,0	3.912,4	76.966,6	22.317,6	445.069,0
2033	18.405,1	386.507,6	0,0	0,0	4.114,5	81.081,1	22.519,6	467.588,6
2034	18.405,1	404.912,7	0,0	0,0	3.925,4	85.006,4	22.330,5	489.919,1
2035	18.405,1	423.317,8	0,0	0,0	3.431,5	88.438,0	21.836,6	511.755,8
2036	18.405,1	441.722,9	0,0	0,0	3.080,1	91.518,1	21.485,2	533.241,0
2037	18.405,1	460.128,1	0,0	0,0	3.511,2	95.029,3	21.916,3	555.157,3
2038	18.405,1	478.533,2	0,0	0,0	4.184,0	99.213,3	22.589,2	577.746,5
2039	18.405,1	496.938,3	0,0	0,0	4.193,3	103.406,6	22.598,5	600.344,9
2040	18.405,1	515.343,4	0,0	0,0	3.001,0	106.407,7	21.406,2	621.751,1
2041	18.405,1	533.748,6	0,0	0,0	3.664,0	110.071,7	22.069,1	643.820,2
2042	18.405,1	552.153,7	0,0	0,0	3.413,9	113.485,5	21.819,0	665.639,2

Ex-ante estimate of non-CO_2 emissions due to forest fire

Non-CO2 emissions from forest fire were not accounted for the baseline scenario.

Table 45 shows expected net change and non-CO2 emissions in the project area. Emissions that occur during the development of the project activities will be monitored and reported, in case of increase in projected emissions in relation to the scenario with the project.

Table 45 Total ex-ante estimate of net real changes in carbon stock and non-CO2 emissions in the project area

Project Year t	Total ex ante carbon stock decrease due to planned activities		Total ex ante carbon stock increase due to planned activities		Total ex ante carbon stock decrease due to unavoided unplanned deforestation		Total ex ante net carbon stock change		Total ex ante estimated actual non-CO_2 emissions from forest fires in the project area	
	annual $\Delta CPAdPA_t$ tCO_2e	cumulative $\Delta CPAdPA$ tCO_2e	annual $\Delta CPAiPA_t$ tCO_2e	cumulative $\Delta CPAiPA$ tCO_2e	annual $\Delta CUDdPA_t$ tCO_2e	cumulative $\Delta CUDdPA$ tCO_2e	annual $\Delta CPSPA_t$ tCO_2e	cumulative $\Delta CPSPA$ tCO_2e	annual $EBBPSPA_t$ tCO_2e	cumulative $EBBPSPA$ tCO_2e
2013	18.405,1	18.405,1	0,0	0,0	4.331,9	4.331,9	22.737,0	22.737,0	0,0	0,0
2014	18.405,1	36.810,2	0,0	0,0	7.448,1	11.780,1	25.853,3	48.590,3	0,0	0,0
2015	18.405,1	55.215,4	0,0	0,0	6.179,0	17.959,0	24.584,1	73.174,4	0,0	0,0
2016	18.405,1	73.620,5	0,0	0,0	3.159,1	21.118,2	21.564,3	94.738,6	0,0	0,0
2017	18.405,1	92.025,6	0,0	0,0	2.966,6	24.084,7	21.371,7	116.110,3	0,0	0,0
2018	18.405,1	110.430,7	0,0	0,0	2.200,1	26.284,9	20.605,3	136.715,6	0,0	0,0
2019	18.405,1	128.835,9	0,0	0,0	3.151,2	29.436,1	21.556,4	158.272,0	0,0	0,0
2020	18.405,1	147.241,0	0,0	0,0	2.814,1	32.250,2	21.219,2	179.491,2	0,0	0,0
2021	18.405,1	165.646,1	0,0	0,0	3.176,1	35.426,4	21.581,3	201.072,5	0,0	0,0
2022	18.405,1	184.051,2	0,0	0,0	3.127,8	38.554,2	21.532,9	222.605,4	0,0	0,0
2023	18.405,1	202.456,3	0,0	0,0	3.588,9	42.143,1	21.994,0	244.599,4	0,0	0,0
2024	18.405,1	220.861,5	0,0	0,0	4.451,1	46.594,2	22.856,2	267.455,7	0,0	0,0
2025	18.405,1	239.266,6	0,0	0,0	3.687,4	50.281,6	22.092,5	289.548,2	0,0	0,0
2026	18.405,1	257.671,7	0,0	0,0	3.907,4	54.188,9	22.312,5	311.860,7	0,0	0,0

2027	18.405,1	276.076,8	0,0	0,0	3.848,5	58.037,5	22.253,7	334.114,3	0,0	0,0
2028	18.405,1	294.482,0	0,0	0,0	3.870,4	61.907,9	22.275,5	356.389,8	0,0	0,0
2029	18.405,1	312.887,1	0,0	0,0	3.981,6	65.889,5	22.386,7	378.776,6	0,0	0,0
2030	18.405,1	331.292,2	0,0	0,0	3.367,7	69.257,2	21.772,8	400.549,4	0,0	0,0
2031	18.405,1	349.697,3	0,0	0,0	3.796,9	73.054,1	22.202,1	422.751,5	0,0	0,0
2032	18.405,1	368.102,5	0,0	0,0	3.912,4	76.966,6	22.317,6	445.069,0	0,0	0,0
2033	18.405,1	386.507,6	0,0	0,0	4.114,5	81.081,1	22.519,6	467.588,6	0,0	0,0
2034	18.405,1	404.912,7	0,0	0,0	3.925,4	85.006,4	22.330,5	489.919,1	0,0	0,0
2035	18.405,1	423.317,8	0,0	0,0	3.431,5	88.438,0	21.836,6	511.755,8	0,0	0,0
2036	18.405,1	441.722,9	0,0	0,0	3.080,1	91.518,1	21.485,2	533.241,0	0,0	0,0
2037	18.405,1	460.128,1	0,0	0,0	3.511,2	95.029,3	21.916,3	555.157,3	0,0	0,0
2038	18.405,1	478.533,2	0,0	0,0	4.184,0	99.213,3	22.589,2	577.746,5	0,0	0,0
2039	18.405,1	496.938,3	0,0	0,0	4.193,3	103.406,6	22.598,5	600.344,9	0,0	0,0
2040	18.405,1	515.343,4	0,0	0,0	3.001,0	106.407,7	21.406,2	621.751,1	0,0	0,0
2041	18.405,1	533.748,6	0,0	0,0	3.664,0	110.071,7	22.069,1	643.820,2	0,0	0,0
2042	18.405,1	552.153,7	0,0	0,0	3.413,9	113.485,5	21.819,0	665.639,2	0,0	0,0

5.5 Leakage (CL2)

Ex-ante estimate of carbon stocks reduction and increased GHG emissions due to leakage prevention measures.

Initially, it is intended that leak prevention measures be carried out within the limits of the Manoa farm, by conducting courses, training and seminars related to sustainable development and conservation and environmental awareness, and once outside the limits of the farm through Assistance to associations of small farmers in the area. These initiatives will focus not only on training and guidance for farmers in the region but also on raising the population's awareness of environmental issues and the preservation of the forest.

According to Section 2, item 2.2 of this document, the development of activities that may reduce carbon stocks or increase GHG emissions is not expected, in comparison with the baseline scenario. However, in case these activities are implemented and result in significant changes in carbon stock, they will be monitored, registered and reported.

Changes in carbon stocks due to implementation of activities in leakage management areas

Table 30c of VM0015 (Step 8.1.1) is not applicable, as reduction due to implementation of activities is not expected.

CH_4 and N_2O ex-ante emissions estimate due to pasture activities

As previously stated, activities resulting in a significant increase in CH4 and N2O emissions are not expected. Therefore, VM0015 Tables 31 and 32 were not applied.

Ex-ante estimate of carbon stocks changes and increased GHG emissions due to leakage prevention measures.

VM0015 Table 33 does not apply.

Ex-ante estimate of carbon stocks reduction and increased GHG emissions due leakage displacement.

As described in Step 3, the agents of deforestation are outside the Manoa area and act largely in the context of illegality. Considering that the project should act indirectly with such agents, fomenting courses, events and workshops for training and awareness of local society, the project expects to reap significant results in the medium and long term. Thus, in this case a 15% displacement factor was adopted for the first ten years.

After this period, a reduction of the displacement factor to 10% in the next 5 years and 5% from the fifteenth year was considered, already considering the influence of the project in this context. In this context, it is important to take into account the fact that, even when monitoring the Leakage Belt, the project proponents do not intend to act directly with the agents involved in the possible deforestation that may occur in areas outside the boundaries of the Project Area. In this way, the leakage displacement factor tends to remain constant for the entire remaining crediting period of the project. Table 46 shows the ex-ante leakage estimate due to activity displacement for the first baseline fixed period and Table 47 shows the ex-ante leakage total.

Table 46 ex-ante leakage estimate due to activity displacement (VM0015 Table 34).

Project Year t	Total ex ante estimated decrease in carbon stocks due to displaced deforestation		Total ex ante estimated increase in GHG emissions due to displaced forest fires	
	annual $\Delta CADLK_t$ tCO_2e	cumulative $\Delta CADLK$ tCO_2e	annual $EADLK_t$ tCO_2e	cumulative $EADLK$ tCO_2e
2013	12.995,8	12.995,8	0,0	0,0
2014	27.930,5	40.926,3	0,0	0,0
2015	30.894,8	71.821,1	0,0	0,0
2016	23.693,5	95.514,6	0,0	0,0
2017	44.498,6	140.013,2	0,0	0,0
2018	33.002,2	173.015,4	0,0	0,0
2019	47.268,7	220.284,1	0,0	0,0
2020	42.211,6	262.495,7	0,0	0,0
2021	47.641,9	310.137,6	0,0	0,0
2022	46.917,1	357.054,8	0,0	0,0

2023	35.889,1	392.943,9	0,0	0,0
2024	44.511,1	437.455,0	0,0	0,0
2025	36.873,7	474.328,8	0,0	0,0
2026	39.073,9	513.402,6	0,0	0,0
2027	38.485,4	551.888,0	0,0	0,0
2028	19.352,0	571.240,0	0,0	0,0
2029	19.908,0	591.148,0	0,0	0,0
2030	16.838,5	607.986,5	0,0	0,0
2031	18.984,6	626.971,2	0,0	0,0
2032	19.562,2	646.533,3	0,0	0,0
2033	20.572,6	667.105,9	0,0	0,0
2034	19.626,8	686.732,8	0,0	0,0
2035	17.157,6	703.890,3	0,0	0,0
2036	15.400,6	719.290,9	0,0	0,0
2037	17.555,9	736.846,8	0,0	0,0
2038	20.920,2	757.767,0	0,0	0,0
2039	20.966,7	778.733,7	0,0	0,0
2040	15.005,2	793.739,0	0,0	0,0
2041	18.319,8	812.058,8	0,0	0,0
2042	17.069,4	829.128,2	0,0	0,0

Table 47 Ex-ante total leakage (VM0015 Table 35).

Project Year *t*	Total ex ante GHG emissions from increased grazing activities		Total ex ante increase in GHG emissions due to displaced forest fires		Total ex ante decrease in carbon stocks due to displaced deforestation		Carbon stock decrease due to leakage prevention measures		Total net carbon stock change due to leakage		Total net increase in emissions due to leakage	
	annual $EgLK_t$ tCO_2e	cumulative EgLK tCO_2e	annual $EADLK_t$ tCO_2e	cumulative EADLK tCO_2e	annual $\Delta CADLK_t$ tCO_2e	cumulative ΔCADLK tCO_2e	annual $\Delta CLPMLK_t$ tCO_2e	cumulative ΔCLPMLK tCO_2e	annual ΔCLK_t tCO_2e	cumulative ΔCLK tCO_2e	annual ELK_t tCO_2e	cumulative ELK tCO_2e
2013	0,0	0,0	0,0	0,0	12.995,8	12.995,8	0,0	0,0	12.995,8	12.995,8	0,0	0,0
2014	0,0	0,0	0,0	0,0	27.930,5	40.926,3	0,0	0,0	27.930,5	40.926,3	0,0	0,0
2015	0,0	0,0	0,0	0,0	30.894,8	71.821,1	0,0	0,0	30.894,8	71.821,1	0,0	0,0
2016	0,0	0,0	0,0	0,0	23.693,5	95.514,6	0,0	0,0	23.693,5	95.514,6	0,0	0,0
2017	0,0	0,0	0,0	0,0	44.498,6	140.013,2	0,0	0,0	44.498,6	140.013,2	0,0	0,0
2018	0,0	0,0	0,0	0,0	33.002,2	173.015,4	0,0	0,0	33.002,2	173.015,4	0,0	0,0
2019	0,0	0,0	0,0	0,0	47.268,7	220.284,1	0,0	0,0	47.268,7	220.284,1	0,0	0,0
2020	0,0	0,0	0,0	0,0	42.211,6	262.495,7	0,0	0,0	42.211,6	262.495,7	0,0	0,0
2021	0,0	0,0	0,0	0,0	47.641,9	310.137,6	0,0	0,0	47.641,9	310.137,6	0,0	0,0
2022	0,0	0,0	0,0	0,0	46.917,1	357.054,8	0,0	0,0	46.917,1	357.054,8	0,0	0,0
2023	0,0	0,0	0,0	0,0	35.889,1	392.943,9	0,0	0,0	35.889,1	392.943,9	0,0	0,0
2024	0,0	0,0	0,0	0,0	44.511,1	437.455,0	0,0	0,0	44.511,1	437.455,0	0,0	0,0
2025	0,0	0,0	0,0	0,0	36.873,7	474.328,8	0,0	0,0	36.873,7	474.328,8	0,0	0,0

2026	0,0	0,0	0,0	0,0	39.073,9	513.402,6	0,0	0,0	39.073,9	513.402,6	0,0	0,0
2027	0,0	0,0	0,0	0,0	38.485,4	551.888,0	0,0	0,0	38.485,4	551.888,0	0,0	0,0
2028	0,0	0,0	0,0	0,0	19.352,0	571.240,0	0,0	0,0	19.352,0	571.240,0	0,0	0,0
2029	0,0	0,0	0,0	0,0	19.908,0	591.148,0	0,0	0,0	19.908,0	591.148,0	0,0	0,0
2030	0,0	0,0	0,0	0,0	16.838,5	607.986,5	0,0	0,0	16.838,5	607.986,5	0,0	0,0
2031	0,0	0,0	0,0	0,0	18.984,6	626.971,2	0,0	0,0	18.984,6	626.971,2	0,0	0,0
2032	0,0	0,0	0,0	0,0	19.562,2	646.533,3	0,0	0,0	19.562,2	646.533,3	0,0	0,0
2033	0,0	0,0	0,0	0,0	20.572,6	667.105,9	0,0	0,0	20.572,6	667.105,9	0,0	0,0
2034	0,0	0,0	0,0	0,0	19.626,8	686.732,8	0,0	0,0	19.626,8	686.732,8	0,0	0,0
2035	0,0	0,0	0,0	0,0	17.157,6	703.890,3	0,0	0,0	17.157,6	703.890,3	0,0	0,0
2036	0,0	0,0	0,0	0,0	15.400,6	719.290,9	0,0	0,0	15.400,6	719.290,9	0,0	0,0
2037	0,0	0,0	0,0	0,0	17.555,9	736.846,8	0,0	0,0	17.555,9	736.846,8	0,0	0,0
2038	0,0	0,0	0,0	0,0	20.920,2	757.767,0	0,0	0,0	20.920,2	757.767,0	0,0	0,0
2039	0,0	0,0	0,0	0,0	20.966,7	778.733,7	0,0	0,0	20.966,7	778.733,7	0,0	0,0
2040	0,0	0,0	0,0	0,0	15.005,2	793.739,0	0,0	0,0	15.005,2	793.739,0	0,0	0,0
2041	0,0	0,0	0,0	0,0	18.319,8	812.058,8	0,0	0,0	18.319,8	812.058,8	0,0	0,0
2042	0,0	0,0	0,0	0,0	17.069,4	829.128,2	0,0	0,0	17.069,4	829.128,2	0,0	0,0

5.6 Summary of reduced or removed GHG emissions (CL1 & CL2)

Ex-ante total net reduction of GHG anthropogenic Emissions

Significance Assessment

Based on the document *"EB-CDM approved" "Tool for testing significance of GHG emissions in A/R CDM Project activities",* we could verify that the above-ground biomass will contribute with 85% of the expected emissions in the baseline scenario. On the other side, below-ground biomass will contribute with 15%.

Ex-ante estimate calculation of GHG emissions total net reduction

VM0015 Equation 19 has been used to calculate the ex-ante estimate of the project emission reduction.

Ex-ante calculation of Verified Carbon Units (VCUs)

VM0015 Equation 20 was applied to estimate the number of VCUs. The project Risk Factor parameter was estimated using the *VCS AFOLU Non-Permanence Risk Too*l, resulting in 10%.

Table 48 Ex-ante estimate of net anthropogenic emission reductions (DREDD) and Verified Carbon Units (VM0015 Table 36).

Project Year t	Baseline carbon stock changes	Baseline GHG emissions	Ex ante project carbon stock changes	Ex ante project GHG emissions	Ex ante leakage carbon stock changes	Ex ante leakage GHG emissions	Ex ante net anthropogenic GHG emission reductions		Ex ante VCUs tradable		Ex ante buffer credits	
	annual	annual	annual	annual	annual	annual	annual	cumulative	annual	cumulative	annual	cumulative
	$\Delta CBSLPA_t$	$\Delta EBBBSLPA_t$	$\Delta CPSPA_t$	$EBBPSPA_t$	ΔCLK_t	ELK_t	$\Delta REDDt$	$\Delta REDD$	VCUt	VCU	VCBt	VCB
	tCO_2-e	tCO_2-e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e
2013	86.638	0	22.737	0	12.996	0	50.904	50.904	44.514	44.514	6.390	6.390
2014	186.203	0	25.853	0	27.931	0	132.418	183.322	116.383	160.897	16.034	22.424
2015	205.965	0	24.584	0	30.895	0	150.485	333.807	132.347	293.244	18.138	40.562
2016	157.957	0	21.564	0	23.694	0	112.698	446.505	99.059	392.303	13.639	54.201
2017	296.657	0	21.372	0	44.499	0	230.786	677.291	203.257	595.560	27.528	81.729
2018	220.015	0	20.605	0	33.002	0	166.406	843.697	146.465	742.025	19.940	101.669
2019	315.125	0	21.556	0	47.269	0	246.298	1.089.995	216.942	958.967	29.356	131.025
2020	281.411	0	21.219	0	42.212	0	217.979	1.307.974	191.960	1.150.927	26.019	157.044
2021	317.613	0	21.581	0	47.642	0	248.388	1.556.362	218.785	1.369.712	29.603	186.647
2022	312.781	0	21.533	0	46.917	0	244.330	1.800.692	215.205	1.584.917	29.124	215.771
2023	358.891	0	21.994	0	35.889	0	301.007	2.101.699	267.317	1.852.234	33.689	249.460
2024	445.111	0	22.856	0	44.511	0	377.742	2.479.441	335.517	2.187.751	42.225	291.685
2025	368.737	0	22.092	0	36.874	0	309.770	2.789.211	275.106	2.462.857	34.664	326.349
2026	390.739	0	22.313	0	39.074	0	329.351	3.118.562	292.509	2.755.366	36.842	363.191

2027	384.854	0	22.254	0	38.485	0	324.113	3.442.675	287.853	3.043.219	36.259	399.450
2028	387.040	0	22.276	0	19.352	0	345.411	3.788.086	308.935	3.352.154	36.476	435.926
2029	398.161	0	22.387	0	19.908	0	355.865	4.143.951	318.288	3.670.442	37.577	473.503
2030	336.770	0	21.773	0	16.839	0	298.158	4.442.109	266.658	3.937.100	31.499	505.002
2031	379.693	0	22.202	0	18.985	0	338.505	4.780.614	302.756	4.239.856	35.749	540.751
2032	391.243	0	22.318	0	19.562	0	349.362	5.129.976	312.470	4.552.326	36.892	577.643
2033	411.452	0	22.520	0	20.573	0	368.358	5.498.334	329.465	4.881.791	38.893	616.536
2034	392.537	0	22.330	0	19.627	0	350.578	5.848.912	313.558	5.195.349	37.020	653.556
2035	343.152	0	21.837	0	17.158	0	304.156	6.153.068	272.025	5.467.374	32.131	685.687
2036	308.012	0	21.485	0	15.401	0	271.125	6.424.193	242.472	5.709.846	28.652	714.339
2037	351.118	0	21.916	0	17.556	0	311.645	6.735.838	278.724	5.988.570	32.920	747.259
2038	418.404	0	22.589	0	20.920	0	374.893	7.110.731	335.312	6.323.882	39.581	786.840
2039	419.334	0	22.598	0	20.967	0	375.768	7.486.499	336.094	6.659.976	39.673	826.513
2040	300.105	0	21.406	0	15.005	0	263.692	7.750.191	235.822	6.895.798	27.869	854.382
2041	366.397	0	22.069	0	18.320	0	326.007	8.076.198	291.574	7.187.372	34.432	888.814
2042	341.389	0	21.819	0	17.069	0	302.499	8.378.697	270.542	7.457.914	31.956	920.770

6 COMMUNITIES

6.1 Community Scenario without Project (CM1)

6.1.1 Characteristics of the community groups surrounding the project

For the social and economic study of the project area, the reference area of the municipality of Cujubim was taken as a sample, plus portions of the municipalities Itapuã do Oeste, Candeias do Jamari, and Porto Velho. However, the primary data were obtained only in Cujubim, and the secondary data were obtained in the other three municipalities. This choice was made because there is a social and economic relationship between Manoa Farm and the municipality of Cujubim, due to access to the area, the creation of jobs and the destination of raw material (wood), and the fact that the activities of the deforestation agents mainly occur based in the Cujubim region.

In addition to the aforementioned relationships, it is also noteworthy that: a) access to the area is via Cujubim; b) the area is contiguous to protected areas, known as Conservation Units, along several segments of its boundaries; c) the settlements for agrarian reform (considered vectors of deforestation) are located in the section between Cujubim and Manoa Farm; d) all other areas are forested, privately held, and used for management plans; e) the areas called “títulos antigos dos soldados da borracha” [literally: “old titles of the rubber soldiers”] are located in the municipality of Cujubim, being used for Forest Management.

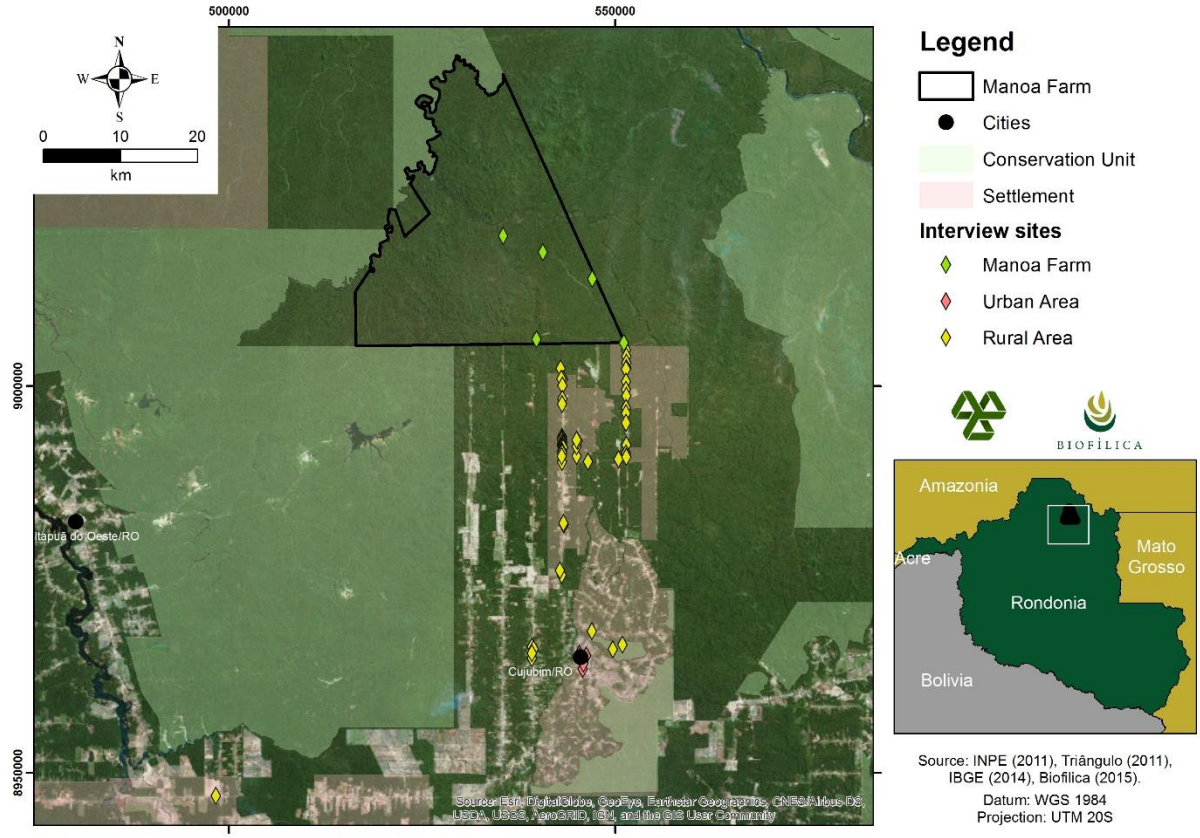


Figure 35 Location of the sites of the interviews conducted for the socioeconomic study.

The choice of methodology for the social and economic analysis of the REDD+ Manoa Project Reference Region took into account the need to combine the data obtained from municipal authorities and government departments, with the information obtained through the field work conducted in the municipality of Cujubim and secondary data.

The actors interviewed by the social study were identified as small ranchers, farmers and squatters in rural areas, employees of Manoa farm, and in urban areas, representatives of the population and local public agencies such as the Municipal Education Secretariat of Cujubim (SEMEC). The questionnaires were formulated containing closed-ended as well as open-ended questions, because this model allows researchers to observe certain subjective aspects of the respondents that might be hidden in a later stage of data tabulation and analysis.

In this way, questionnaires were used, applied to three groups of the study population, rural area, urban area and farm workers, which served as a basis for further analysis. The questionnaires were applied in field work conducted October 08–17, 2014. The number of questionnaires referred to the sampling effort obtained in the time allotted for the field survey. This procedure was chosen in the field stage, as the following activities were carried out in this period: Interviews with residents of the urban and rural areas of Cujubim and the workers at Manoa farm. Additionally, researchers' perceptions were obtained during this period regarding the situation of the municipality. The researchers also contacted staff members of municipal government departments, with whom open interviews were conducted and saved on audio recordings, with the permission of the interviewees.

Educational Aspects

In the rural area of Cujubim, according to the 2013 school census, there were 838 enrollments all in Municipal school (Table 49). Only students attending rural schools have access to transportation. There is no school transportation contemplating students who need to go to the urban nucleus to study.

Table 49 Enrollment in rural Schools of Cujubim in 2013. Source INEP, School census 2013.

EMEF Área Rural Cujubim/Anos Escolares	Matrículas em 2013
1º ao 5º	447
6º ao 9º	391
Total	838

Among the families interviewed in field work carried out in this municipality, we verified the levels of education described in Figure 36. It can be seen that, as in the urban area, a large number of people (52%) frequenting primary school or just part of it. It is also noticed that 9% did not complete high school, suggesting the occurrence of school drop-out, possibly due to the need for secondary education rural schools or in the urban area, necessitating the use of school transportation.

The illiteracy rate is around 9%, which is equal to the Brazilian rate and slightly lower than the northern region, which is 10.6% (IBGE, 2010). Attention is drawn to the rate of people with a complete or incomplete higher education level, which did not appear in interviews in the urban area, this information should be analyzed with caution as it may not represent the reality of Cujubim higher education professionals, since interviews eere sampled within the error limits.

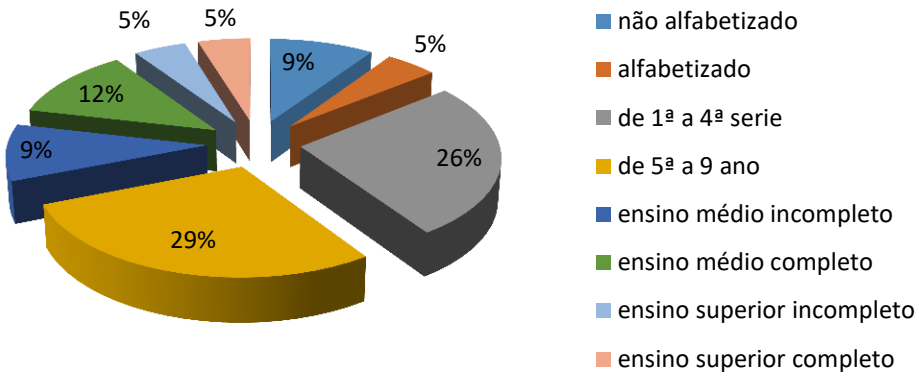


Figure 36 Levels of education of families in the rural area of Cujubim/RO.

Health aspects

The presence of sawmills in the city, the main economic activity of the Municipality, ends up having a direct influence on the health related issues of the inhabitants, mainly in the urban area of Cujubim. What happens is that the sawmill waste is used as raw material for charcoal plants (Figure 37) that act to release smoke, contributing to the presence of respiratory diseases. This information was informed by the Municipal Health Secretary when being interviewed.

Figure 37 Charcoal plant located in the municipality of Cujubim/RO.

Regarding the sanitation of the residences, Cujubim does not have a sewage treatment network and in the rural area, the use of rudimentary cesspit prevailed and in the urban area the use of septic tank. In both cases this issue is of concern in terms of health, since the second CAERD servant interviewed, contamination of rivers and wells due to the use of pits can occur if they are not more than 600 meters from the pit. According to this servant, in the urban area the contamination of wells occurs in all the residences that use them.

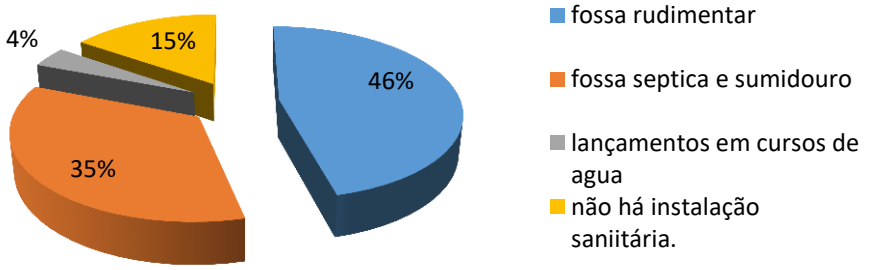


Figure 38 Sanitary Installation in Rural Area of Cujubim/RO.

Regarding access to health services, there was dissatisfaction among the population. Part of this is due to the existence of only one UBS (Basic Health Unit), insufficient to meet the entire resident population in the rural and urban areas of the Municipality.

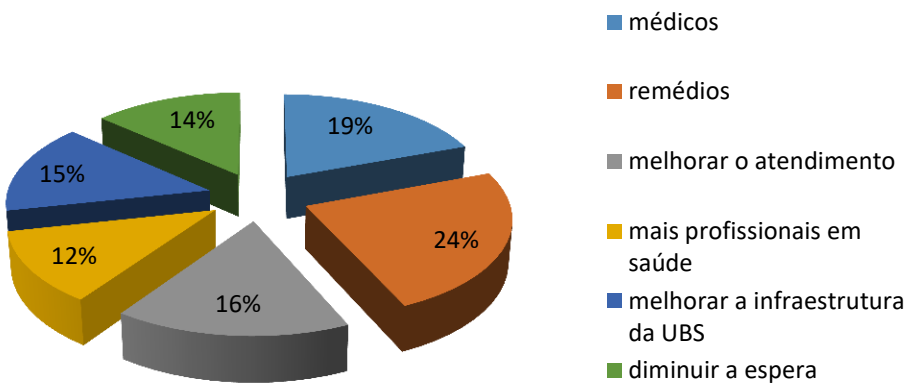


Figure 39 Municipal UBS needs identified by rural area respondents

These graphs point to similar perceptions regarding the needs of the Basic Health Unit of the Municipality of Cujubim. It was a UBS because both the population living in urban and rural areas of the Municipality are served by UBS located in the urban area of the Municipality. This especially hampers access to care for families in rural areas, who are often in difficulty to transport to the city.

With regard to diagnosis of diseases, was obtained information from the SINAN - Information System on Aggravation and Notification, that the incidence of Leishmaniosis is a concern in the Municipality, however none of the interviewees in an urban or rural area stated that they knew of any cases in the family. This servant also reported a high incidence of Hepatitis, Leprosy and Syphilis, diseases that were also not mentioned and/or appeared in few interviews. The diseases most declared by the interviewees were malaria and dengue. Another cause for entry into the service of the UBS narrated as very frequently by the servant are the cases of work accidents related to the activities in the sawmills. These cases were also not mentioned by people interviewed in rural and urban areas.

Another issue of relevance raised by the employees of the health department of Cujubim is that the greatest cause of mortality among the inhabitants is homicide. It is a question related to public safety and the offer of other social devices, but this data ends up being filed by the health department, in view of the entrance to the emergency room. Another problem was the presence of a high number of abuse

against minors, practiced mainly by those responsible for the child, a fact also pointed out by the guardianship council during an interview.

Chemical dependence is a health problem, however, because there is no CAPS - Center for Psychosocial Care in the Municipality of Cujubim, cases are attended in the municipality of Ariquemes, therefore, there is no record of how many dependents residing in Cujubim were treated in this other County.

Characteristics associated with gender

Women currently constitute a work force working in services that were previously classified as exclusively male. In the urban area, the field research revealed the presence of female heads of household and contributing to the monthly income of the residence, however in more than 50% of the interviews it was verified that the income was less than R $ 1,000.00/month.

In the case of the performance of women in the Rural area of the Municipality of Cujubim, respondents in the majority declared the women not participating in the family income. It may be thought that in this context, although women often perform various activities in the agricultural production phases, their labor is not accounted for and remunerated. However, it is not possible to deepen the discussions because these would require a longer time in the field so that the researchers perceive some nuances of social life that do not arise immediately with the interpretation of the questionnaires.

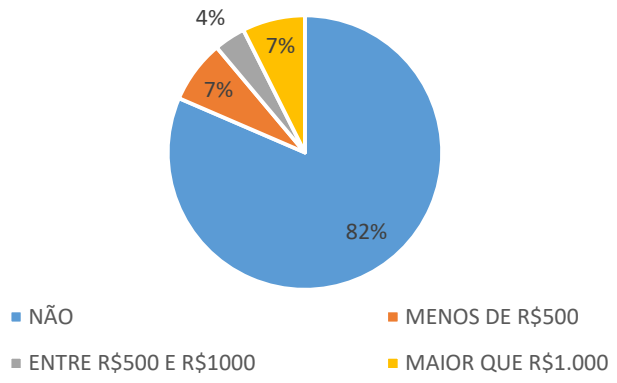


Figure 40 Contribution of women in the annual income of Rural Property in Cujubim/RO.

Economic characteristics

In the rural income, it was difficult to quantify annually, due to the lack of control of the production by the producers. As for example the sale of the coffee that is made when the product is still green, since the producers interviewed stated that they can not dry coffee or expect an improvement in the price, pointing to lack of infrastructure for activity, and with that, they can not have control of how much was harvested and what the value of the sale.

Figure 41 shows the income of the people interviewed, and it should be noted that rural income was obtained taking into account only the annual production data of the property. In the case of the homemade interviewees, there were cases where they could not report the annual income of the property or did not want to respond.

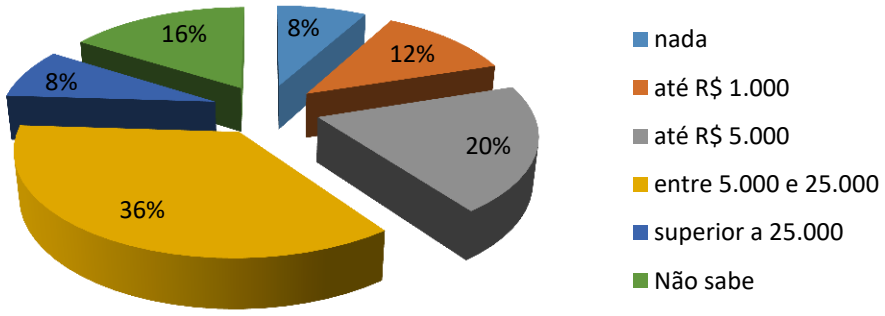


Figure 41 Average annual income of the inhabitants of the Rural area of Cujubim/RO. Source: Ecoporé, 2014.

The sawmills scattered throughout the urban area of Cujubim represent the main economic activity of the municipality and make the beneficiation of the logs, according to the IBGE (2013) the production of logs in cubic metric was 379,380 (Table 50). Third largest exploration in the State of Rondônia, behind only Porto Velho and Candeias do Jamari, both municipalities located in the project reference region. The total amount of the region is 2,275,439 m³, which corresponds to 57% of the total extracted in the entire state of Rondônia. On the other hand, Cujubim is designated as an illegal wood extraction municipality, being the target of Operation Arc of Fire in 2008, and according to residents' reports, the operation paralyzed the city. Cujubim has also as economic sources the public and agricultural functions.

Table 50 Timber and log production in the municipalities of the project reference region, total of other municipalities in the state of Rondônia and total of the state.

Municipality	cubic metric **/year/2013**	**Participation in the reference region %**	**State Participation**
Candeias do Jamari	379.380	17%	9%
Cujubim	354.418	15%	9%
Itapuã do Oeste	20.408	1%	1%
Porto Velho	1.521.233	67%	38%
Total Reference Region	2.275.439	100%	57%
Other Municipalites of RO	1.727.865	0%	43%
Total RO	**4.003.304**	**100%**	**100%**

Family farming for economic purposes appears timidly and only with the sale of coffee (not yet mature) to cerealists in the municipality of Cujubim, in other cases subsistence farming is used as the planting of corn to feed the hicks that divide The backyard space with fruit orchards. However, the conventional grain crop, especially rice and soybeans, which according to the municipal secretary of agriculture is already over 5,000 hectares, begins to appear quite intensely in the municipal areas.

Looking for information on possible land use changes, the continuity of the activities already developed in the case the dairy farming was the most cited, however the cultivation of coffee, corn, banana, cassava and fish farming appear as alternatives of use from soil.

The indiscriminate use of fire mainly during the dry season worries environmental authorities in Brazil and Rondônia. In 2012, the Secretary of State for Environmental Development-SEDAM, issued Decree 211 where it grants the controlled burn and gives the Regional Offices of SEDAM the authority to issue the authorizations. The use of fire by rural producers occurs because of productive activities on the properties. In the State of Rondônia, as already mentioned, authorization is required, however, the figure below shows that 67% of respondents did not request the document and 22% did not respond, only 11% of respondents said they asked for permission to carry out fires.

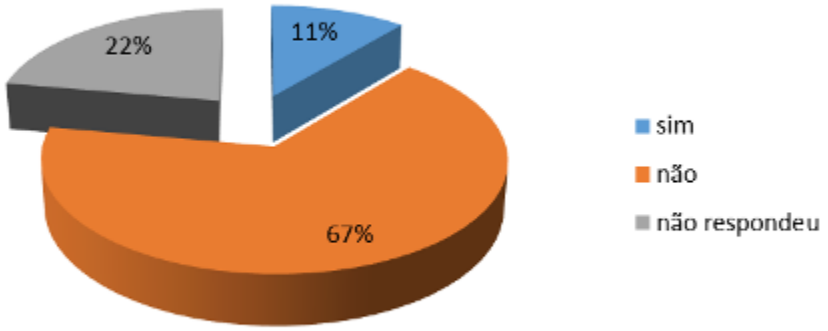


Figure 42 Percentage of respondents requesting authorization to carry out fires on their properties in the municipality of Cujubim/RO.

Figure 43 Areas with burnings for pasture cleaning (photo on the left) and new felling using fire for cleaning (photo on the right).

The presence of large farms, occupied with livestock and soybeans and also small farms producing milk, cocoa, coffee and subsistence agriculture, was verified in the field work around the Manoa farm. The above fact can be exemplified in two very clear moments found in the field, one that refers to the incorporation of rural plots by farms and another by the maintenance of family agriculture.

In the first case (Figure 44 and Figure 45), it is immediately after the main entrance of the Manoa farm, a rural property of a merchant from the town of Machadinho do Oeste (Fazenda Bom Princípio). After entering this farm were found three small houses along the side of the road, certainly were residences of family farmers and one day had their rural lots incorporated into the farm area.

Figure 44 Location of the entrance of Manoa farm, and bordering rural property (farm Bom Principio) and location of abandoned houses next to the farm probably lots of family farming incorporated into the farm.

Figure 45 Abandoned houses in the rural area of Cujubim, near Manoa farm, possible rural plots of family agriculture incorporated into Bom Principio farm.

In the second case, in the other two secondary roads that finish in the limit of the Manoa farm, the majority of the properties are of small rural lots. However, most of the interviewees pointed to the inefficiency of public policies, focused on health, education in the field and technical assistance as the main causes of abandonment and sale of rural properties, together with deficiencies in the soil and lack of resources for investments in land reclamation and acquisition of agricultural inputs.

6.1.2 High Conservation Value Attributes

The project does not include High Conservation Value Attributes (HCV) related to community well-being.

6.1.3 Future scenarios in the absence of the Project

Based on the evaluation carried out, it was possible to verify that there are three basic concepts widely discussed that permeate the context of land use in the region: a) the decline of timber extraction; b) conversion of forests into pastures; c) increase of agricultural mechanization.

The decline in potential timber is a matter of time, since no municipality in Rondônia has managed to exceed 15 to 20 years of intense exploration, considering that since 2000 the timber sector has grown rapidly in the region, there are still 5 to 10 years to fall. This fact is due to a series of factors, among them, the lack of effective action of the State in supervision and licensing of the activity; and lack of commitment of a large part of the sector to socio-environmental issues and sustainability, which are posed as "obstacles to development". This decline scenario will certainly cause economic losses to the municipality of Cujubim, since the timber sector is responsible for moving the economy of the city, making possible the generation of jobs in the region.

The downturn of the timber industry inevitably entails converting forest into pasture, since from a capital viewpoint, the forests that once served to leverage the region’s economic environment are no longer of importance, due to the absence of tree species with economic value. Thus, people turn to cattle raising, planting pastures of African origin in these areas, which will cause imbalance in the mostly polymorphic soil structure (low natural fertility). For cattle raising, there is a complete framework provided by the State to support the activity, as well as guaranteed marketing of production, in addition, several studies such as the Land Market Analysis (FNP, 2016) indicate that pasture areas can generate a valuation of up to five times the value of land compared to forest areas. Initially, the activity encompasses those farmers who, over the years, ended up leasing or selling their lands to small business owners in the

area, because they were not able to obtain the capital to invest in improving pastures, which become deteriorated due to soil depletion, leading to low productivity levels per hectare.

As an alternative to the weakening of the soil, agricultural mechanization and monoculture, especially soy, begin to appear, which finds deforested areas, with low cost of mechanization, cheap and depleted lands. These facts are attractive to those who have technology and knowledge to invest in the activity. If this scenario is confirmed, it will, in turn, involve the incorporation of areas that are currently used for livestock and agriculture management, which will result in real estate marketing and speculation, with a consequent rural exodus, or removal of family farmers to new areas of cultivation and/or livestock and may result in pressure on the remaining forest areas.

In this context, one must consider that the municipalities in the reference area are located in the region known as the “Arc of Deforestation,” because of the actions related to illegal logging as well as the advancement of agriculture and livestock; notably it has been observed statewide that the Conservation Units and Indigenous Lands are areas with better conservation and preservation, and yet have suffered the most diverse types of pressure (encroachment, illegal timber extraction, loss of biomass and biodiversity, among others) and the many different communities are beset by constant threats, including to their physical integrity. The pressure of protected areas in recent years is partly driven by the exhaustion of logging in settlements, private and non-titled areas, and most of these areas are currently converted for agricultural or totally degraded uses, with few exceptions such as Manoa farm.

It is also noted that the state agencies and the representations of the executive, legislative and judicial branches, due to a series of structural difficulties or even omission have not been satisfied in their role of supervision and territorial planning, which favors the action of agents and related drivers of deforestation and forest degradation.

In this context, it is not possible to verify, from an assessment of plausible scenarios for land use in the region, that there will be a short and medium term change in the chain of events that leads to deforestation and conversion of forest areas. The probable continuity of this scenario is due to two main factors, primarily due to the lack of efficiency of the State in its role of monitoring and territorial planning, a fact that generates land insecurity and encourages illegal activities, the second factor is related to the low value of the forest in Due to the lack of public policies in this area and the low incentive to private initiatives to operate in the forestry sector in a regular and sustainable way.

The most effective way to change the common practice scenario in the region must be through valuing the forest and its natural resources through public policies, consistent studies and specific incentives to attract the interest of private initiative. The analysis shows that environmental awareness is

not enough to provide conservation without offering real alternatives to generate sustainable economic development in the region.

In a catastrophic scenario, it is possible that the situation in the region will worsen the indicators of deterioration, considering that there is noticeable low self-esteem among the population, which at the moment is practically abandoned in the following categories: a) social (education, healthcare, housing, communication, housing conditions, leisure and cultural areas, and other infrastructure); b) economic (employment, income, agriculture and alternatives to promote diversification and vertical integration of production); c) environmental (potentiation of invasions and illegal extraction of natural resources; d) political–associative (with the weakening or disintegration of their representative entities).

6.2 Net Positive Community impacts (CM2)

With the implementation of the REDD+ project it is possible that social, economic, and environmental conditions can be partially strengthened in Cujubim, as it is believed that several initiatives can be triggered from the proposed actions, generating support for sustainable socioeconomic development in the region. Among the actions, activities and programs should be considered a continuous process of training local actors in forest management techniques, agroforestry systems, waste management, low carbon agriculture, among other initiatives. In addition, the project plans interventions directly with schools to provide environmental education workshops and mini courses addressing the socio-environmental theme. This is expected to provide greater experience and technical knowledge, contributing to the development of the region.

These proposals are important tools for changes in the common practice scenario in the region. In terms, the REDD+ Project appears as an important opportunity for the local society in the sense of generating socioeconomic development with sustainable bases that allow the maintenance of the integrity of the forests, so that they can guarantee a better quality of life to the current and future generations.

The REDD+ Manoa project aims to improve human relations and institutional strengthening, aiming at improving the quality of life of the surrounding population. Taking these aspects into account, it is expected that the project can contribute with several positive impacts, such as:

- Decrease and stabilization of deforestation areas in the surroundings;
- Recovery of degraded areas;
- Potentiation of sustainable productive activities;

- Direct and indirect generation of work and income;
- Development of preservation / conservation actions;
- Promotion of actions aimed at environmental education among other initiatives such as sports incentives and preventive health;
- Implementation of training courses, in addition to technical assistance.
- Strengthening associations of local representative bodies;

With regard to possible negative impacts generated by the implementation of the project, it is understood that such impacts could be triggered mainly from failures in the communication process among the social actors directly or indirectly impacted by the project. The project communication procedures were listed in section 2.7, as well as the risk associated with communication failures, which may result in lack of engagement, disbelief and conflicts among the actors involved.

The assessment of project impacts will be based on the Theory of Change logic, as described in Table 5 that is, by monitoring the implementation of the activities proposed by the project, and the documentation of the procedures applied, results achieved and possible impacts generated in relation to each action taken. The assessment of possible negative impacts, as well as the definition of mitigating measures, should be carried out through the maintenance and strengthening of the communication procedures proposed by the project in section 2.7.

It is possible to assume that through a well alignment between the parties involved in the project and the maintenance of an adequate communication and feedback procedures, most of the risks inherent to the implementation of the project that would lead to negative impacts could be mitigated. Therefore, it is expected that from the implementation of adequate measures to mitigate risks and negative impacts (to be defined in the assessment period of the carried out activities) the project should ensure positive net impacts to social groups and stakeholders directly and indirectly involved in the actions implemented during and after its duration.

6.3 Other Stakeholders Impacts (CM3)

All the stakeholder groups impacted directly or indirectly by the project were included in a undifferentiated way in sections 6.1 and 6.2. of this document, so the project does not expect to generate impacts to other stakeholders, other than those actors already considered in this plan. The project

implementation as well as the proposed actions should not affect the rights of any stakeholders, either in access to resources, or in access to information related to the REDD+ project.

6.4 Exceptional benefits for the communities (GL2)

This section does not apply to the project.

7 BIODIVERSITY

The state of Rondônia has much of its territory located in the "Rondônia Endemism Center," considered one of the most important bird endemism areas of in South America (CRACRAFT, 1985), and the region is classified as one of the few global IBAs (Important Bird and Biodiversity Areas). The area has extreme ecological complexity due to the fact that almost all the rivers of the interfluvial system flow into the Madeira river (WILLIS, 1969).

The project area is located in the region of the Madeira river basin, southwest of the Amazon biome, a region that is seen as great potential for biodiversity; however, the area historically has few studies (WHITTAKER, 2008) and has suffered from increased anthropogenic pressure in recent decades (PY-DANIEL et al., 2007). The region is composed of a mosaic of protected areas – called Conservation Units (Figure 46) – such as National Forests, Sustainable-Yield State Forests, Extractive Reserve and Ecological Station, and comprises one of the state's main foci for biodiversity conservation.

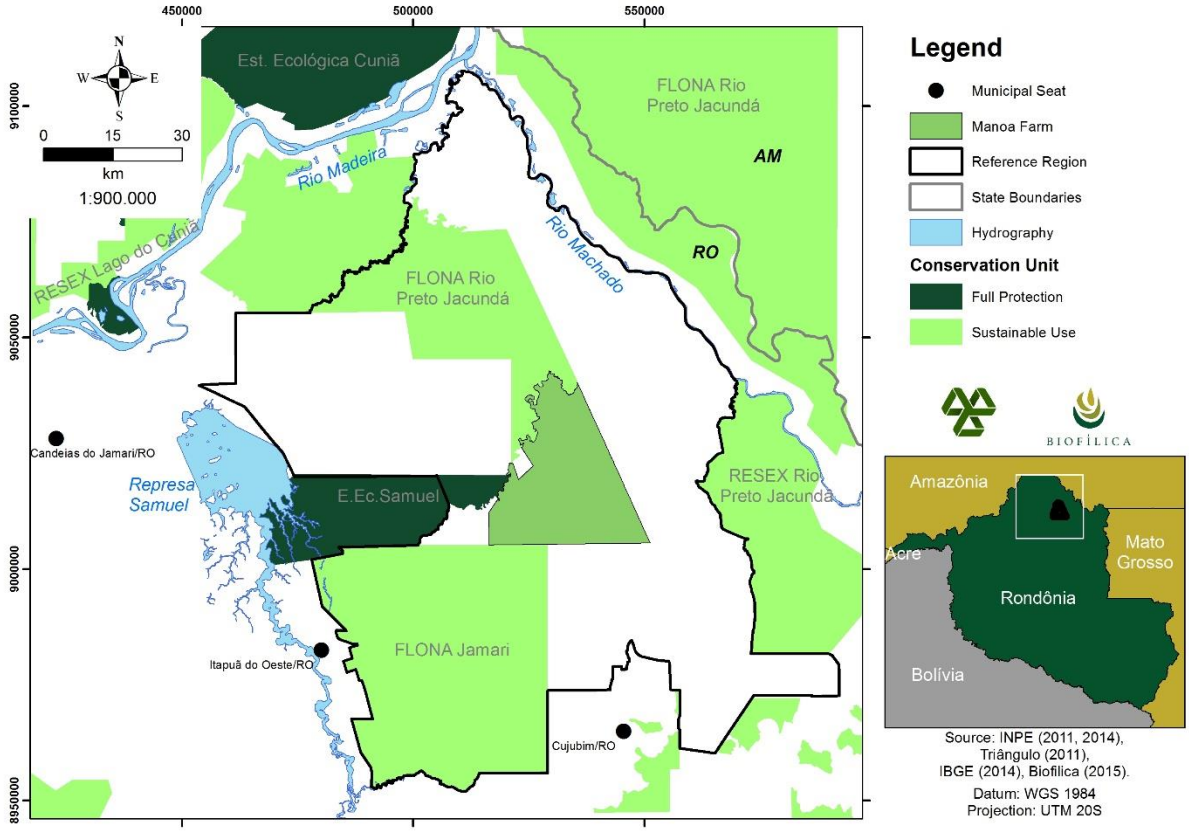


Figure 46 Location of the Project Area and Conservation Units in the surrounding area.

Reduced-impact management, which is carried out in the project area, can be considered as an alternative to biodiversity conservation, in such a way that generates financial resources and provides for forest maintenance compared to the current scenario in the region, which is characterized by land conflicts as well as forest degradation and deforestation.

7.1.1 Flora

For a description of the structure and composition of the existing forest cover in the project area, we adopted the methodology used for the carbon inventory assessment. The sampling of vegetation was carried out in clusters in the shape of a Maltese cross, with four sampling subunits measuring 10 m x 250 m (Figure 33). For the phytosociological assessment, the four sub-plots existing in each cluster were considered so as to correspond to a single sampling unit, with total area of 1 hectare.

The distribution of the plots was ordered by stratifying the Project Area according to criteria of the forest types mapped in the IBGE database and the existence or absence of exploitation in a reduced-impact forest management arrangement. According to the approach of the vegetation types presented by the IBGE (2014), there are four predominant types of formations, and only two types with the greater scope and spatial representation for the area of interest were considered: open rainforest lowlands with palm trees (“FOATB”) and open submontane rainforest with lianas (“FOAS”).

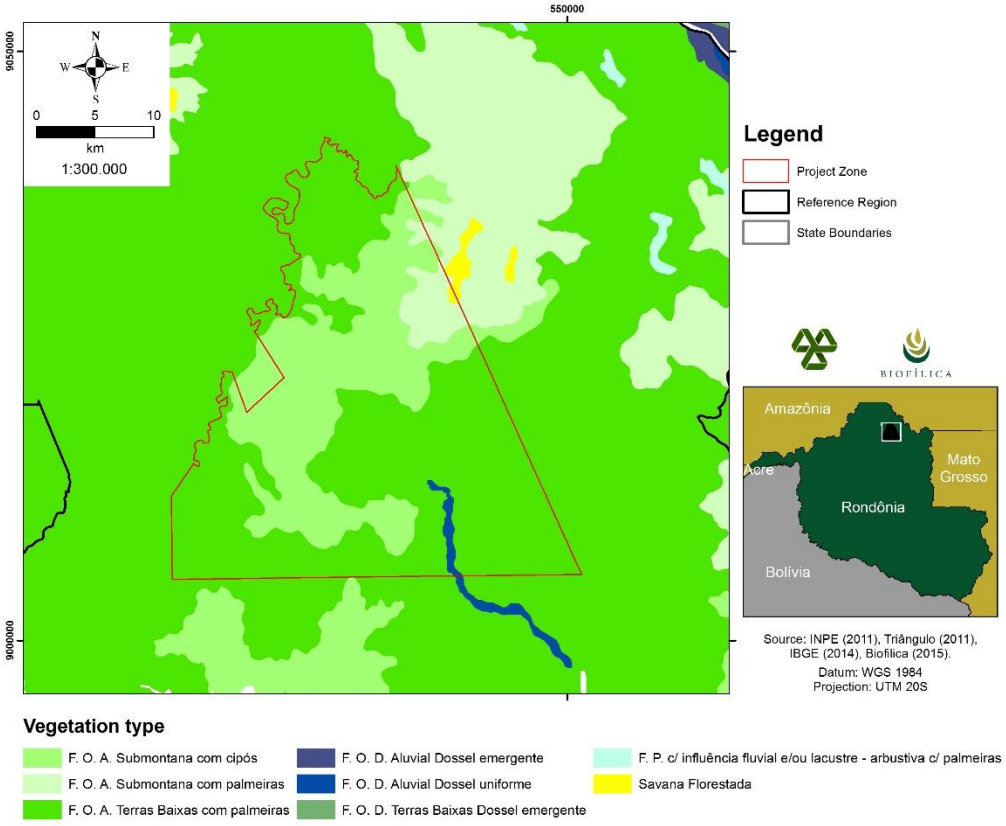


Figure 47 Forest formations present in the Project Zone.

In each sampling unit, the diameter at breast height (DBH) ≥ 10 cm was measured, so that only individuals that have reached the minimum diameter were identified. The identification of inventoried individuals was carried out based on the contribution of woodsmen experienced in recognizing the

common names of the species, and subsequently correlated with the scientific names of identification reports conducted at Manoa Farm.

All of the scientific names were updated following the nomenclature available in the database of the List of Species Flora in Brazil and verified with regard to the degree of threat to national and international lists of the Ministry of the Environment (MMA) and the International Union for Conservation Nature (IUCN).

Phytosociology

The survey conducted at Manoa Farm, considering the thirty sample units of one hectare each, totaled a record of 16,021 individuals distributed among 177 tree species belonging to 45 botanical families. The analysis was performed by comparing the composition of species in the two formations defined by the IBGE mapping. In the lowland open rainforest, the number of species identified was 155, distributed among 42 families. As for the submontane open rainforest, 159 species were recorded, among 45 families; of these, 140 are present in both formations, 15 are exclusive to lowland open rainforest, and 19 are exclusive in the plots allocated in submontane open rainforest.

Virtually all the exclusive species sampled in both phytophysiognomies showed low natural density in the forest, and for most of them only a single individual was recorded. Among the species sampled exclusively in each phytophysiognomy, we highlight *Cedrela odorata* (known locally as “cedro-vermelho”) in the submontane forest, a species previously very commonly found almost throughout Brazil, and due to the high commercial value of the wood, is now currently restricted to certain areas, being cited as vulnerable on the list of endangered species (IUCN, 2015). The palm species *Mauritia flexuosa* (“buriti”) was found exclusively in the areas lowland open rainforest, and this species can be considered exclusive of low-lying areas, always occurring near rivers and variable tributary zones.

The two main forest types present in the area show great similarity in the tree layer, so that the occurrence of unique species are mainly explained by the low density of these species. Accordingly, a single forest type was considered for the farm, stratifying the data only into exploited and non-exploited (i.e., logged and non-logged) areas. The aim of this evaluation was to diagnose whether reduced-impact logging brings about significant variations in the natural patterns of species.

The analysis of the phytosociology of the exploited and non-exploited areas was based on the Importance Value Index (IVI), which is determined based on the sum of the density, frequency and relative dominance of a species, expressed in percentages. The number of individuals identified in areas

that have not been managed on Manoa Farm was 8,164, belonging to 155 species. However, for the managed areas, 7,857 individuals and 162 species were recorded. In terms of diversity of plant families, the number identified in non-exploited areas was 42 families, and 45 in exploited areas. Figure 48 shows the species with higher IVI values within the fifteen plots located in areas where logging occurs.

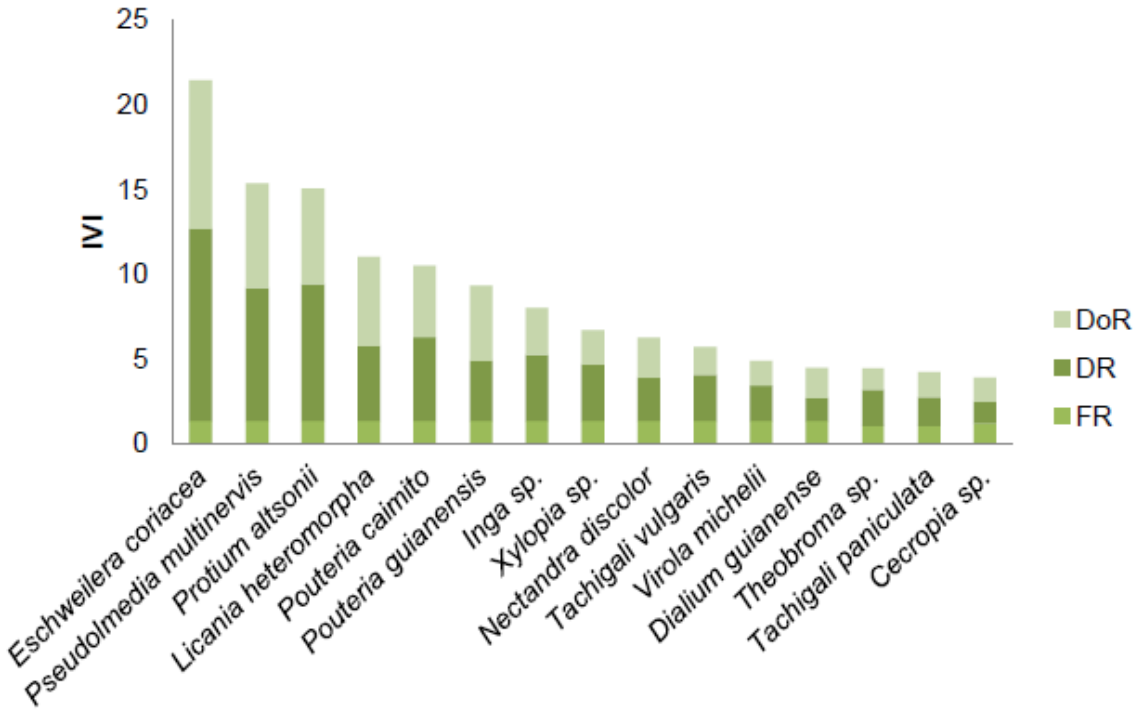


Figure 48 Importance Value Index (%) of the fifteen main species sampled in the logged areas of Manoa Farm. Source: Casa da Floresta (2015).

The same survey was conducted in non-exploited areas (Figure 49), where some species, such as *Pouteria caimito* (known locally as “abiu”) and *Tachigali paniculata* (“taxi”) were found in smaller IVI values in the exploited area. On the other hand, the species *Peltogyne lecointei* (“roxinho”), *Copaifera guyanensis* (“copaíba”) and *Dendrobangia boliviana* (“caferana”) present among the first 15 species of higher values of importance in the non-exploited areas, are among the top 25 of the exploited areas.

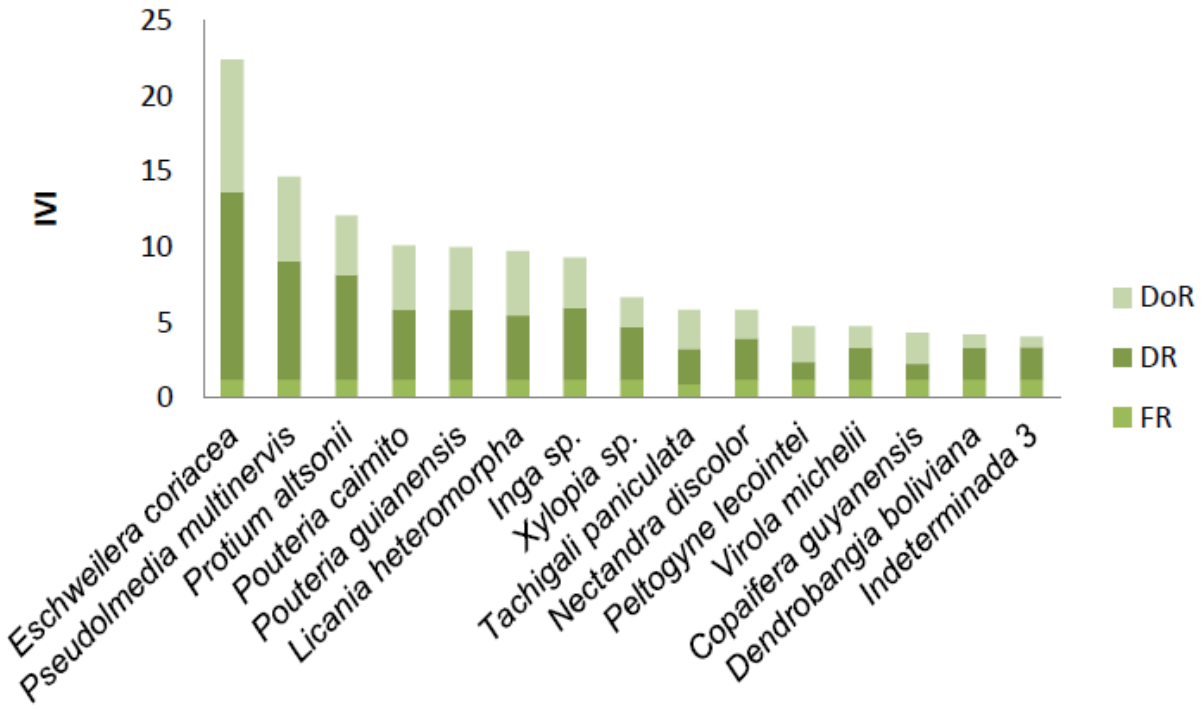


Figure 49 Importance Value Index (%) of the fifteen main species sampled in non-exploited areas of Manoa Farm. Source: Casa da Floresta (2015).

The assessment of phytosociological parameters and the comparison between the exploited and non-exploited areas showed that the forest on Manoa Farm, despite management intervention, maintains its natural characteristics of structure and composition.

The differentiation in the composition of flora observed between the two categories of sampled areas can be attributed to the “Intermediate Disturbance” hypothesis (Connel *apud* Ribeiro Neto, 2009), caused by factors of disturbance that interfere with the dynamics of species establishment. It was observed that among the species that were identified exclusively in managed areas, 45% are pioneer species, a fact that indicates favoring the colonization of open areas by individuals with a tolerance to light, contributing to the increase of the wealth of species in the area subjected to disturbances when compared to areas where there was no exploitation.

The fact that there are differences in the wealth of species between the two categories can thus be attributed to the disturbance caused by forest management. However, it is noteworthy that because

this is an area of Open Rainforest, the project area does not necessarily show changes in the composition of flora within the two categories due strictly to disturbance factors. Of course, the regional phytophysiognomy corresponds to formations with spaced individuals, resulting in discontinuity in the canopy formed by the climactic tree layer.

Based on the data surveyed, it is possible to assert that the application of good management practices has maintained the integrity of the forest at Manoa Farm, assuring the maintenance thereof, which is of the utmost importance in the regional landscape, where it forms a large forest massif with other adjacent Protected Areas.

Regarding endangered species, the lists formulated by IBAMA and IUCN are also instruments of control of exploitation of species at risk. The result of the survey of species that occur in the Project Area resulted in eight species included on the lists of endangered species with some degree of threat.

Table 51 List of endangered species that occur in the Project Area (with respect to the degree of threat of the species listed in the table: EN = Endangered, VU = Vulnerable, CR = Critically endangered.

Family	Species	Vernacular name	Level of threat	
			IUCN	IBAMA
Fabaceae	*Apuleia leiocarpa*	garapeira		VU
Fabaceae	*Vouacapoua americana*	angelim-de-folha-larga	CR	EN
Lauraceae	*Mezilaurus itauba*	ataúba	VU	VU
Lecythidaceae	*Bertholletia excelsa*	castanheira (Brazil nut tree)	VU	
Lecythidaceae	*Couratari guianensis*	tauari	VU	VU
Meliaceae	*Cedrela odorata*	cedro-rosa	VU	VU
Rutaceae	*Esenbeckia leiocarpa*	guarantã	VU	
Sapotaceae	*Manilkara elata*	maçaranduba	EN	

Source: Adapted, Casa da Floresta (2015).

Among the species which should be assigned greater attention when managing, it is important to highlight *Hevea brasiliensis* (rubber tree), which shows high potential in the generation of non-timber forest products (latex), and *Bertholletia excelsa* (Brazil nut tree), which in addition to presenting the

possibility of non-timber management, is restricted to exploitation (included on the list of endangered species).

7.1.2 Fauna

The survey of wildlife based on primary field data within the project area was aimed at contextualizing and understanding the importance of the forest on the Farm in relation to the regional scenario. Thus, secondary data were also collected for the municipalities of Porto Velho, Candeias do Jamari, Itapuã do Oeste, and Cujubim, which are located in the Reference Region of the project.

For primary data collection, carried out in November 2014, four sampling areas were selected, so that the sampling could serve as a comparison between different stages of management. Of these, three are called Annual Production Units (UPAs), i.e., they constitute areas earmarked for management, one of which is newly managed, with logging between 2013/2014 (UPA 07), one was logged in 2011 (UPA 14), and another with logging planned for 2015/2016 (UPA 27). The other location selected was the Absolute Reserve (RA), because it is an area that will not undergo management intervention and is therefore considered in the evaluation as the “control area.”

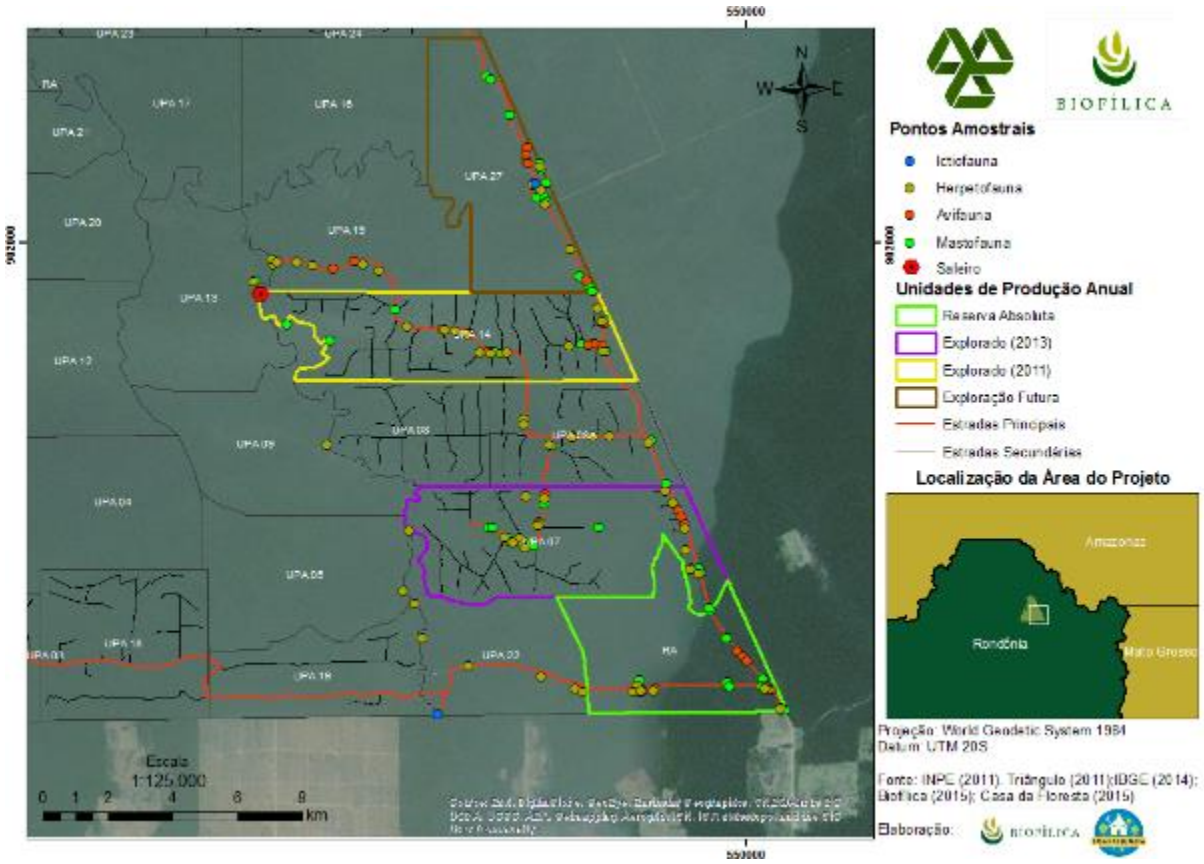


Figure 50 Location of the areas selected for wildlife sampling and sample points

Herpetofauna

In all, we compiled – through secondary data – 235 species of herpetofauna (amphibians and reptiles) with possible occurrences for the Project Zone. Amphibians correspond to 84 species, belonging to 11 families. The 151 species of reptiles identified are represented by six species of turtle distributed in three families; four amphisbaenians (worm lizards) from one family; snakes account for the majority of the records: 100 species distributed among eight families.

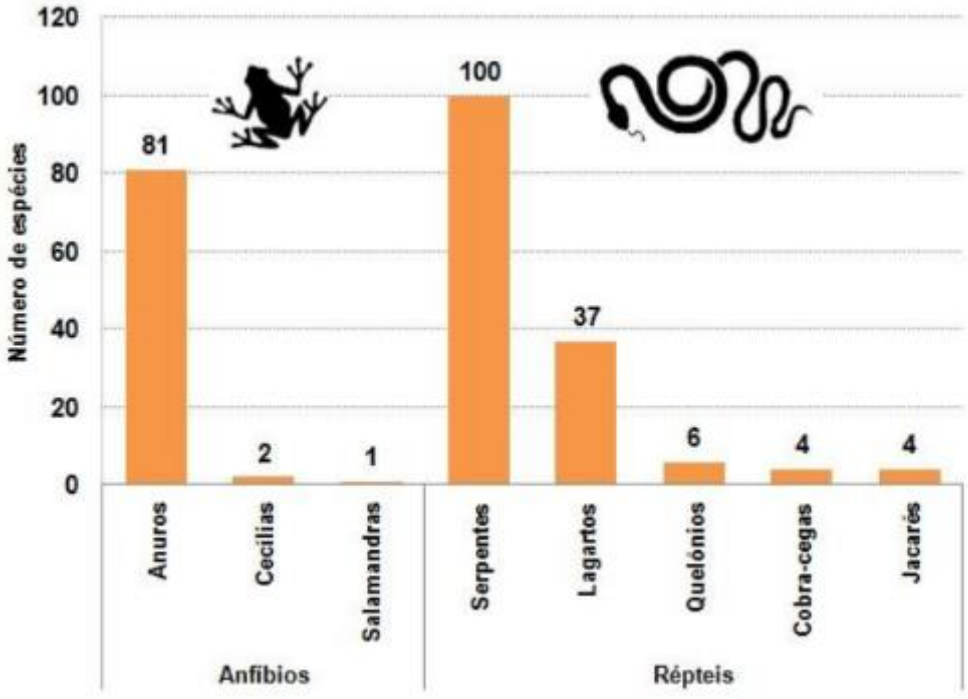


Figure 51 Number of species related to amphibians and reptiles obtained through secondary data for the project area. Source: Casa da Floresta (2015).

Among the species listed as endangered, only *Allobates brunneus* (known locally as "sapo-flecha') is classified as a critically endangered species (CR) on the Brazilian list of endangered species (ICMBIO, 2014); with regard to lizards and snakes, no species identified is classified under any degree of threat. According to IUCN criteria, two turtle species (*Podocnemis unifilis* and *Chelonoides denticulata*) and one caiman species (*Caiman crocodilos*) are considered vulnerable (VU), a fact that is related to exploratory hunting, habitat loss and degradation, and the low density with which these animals occur in nature.

At Manoa Farm, 44 species of herpetofauna were recorded in the field, among which 30 are amphibians and 14 are reptiles. Considering the low number of sampling days (ten), high local diversity was observed, and the greater the number of sampling days, the more the number of data collected tends to increase. In the case of some amphibian species, such as frogs/toads, the distribution can be temporal as well as spatial, i.e., accompanying the seasons and weather throughout the year.

Among the 84 amphibians of probable occurrence in the project area, 24 are common species with the data presented; this means there is a chance that more than 60 different species inhabit the site, and six species were unique to the project area, not being found in the secondary data consulted (*Dendropsophus rhodopeplus, D. sarayacuensis, Phyllomedusa camba, Scinax* cf. *nebulosus, Trachycephalus resinifictrix*, and *Chiasmocleis avilapiresae*). In contrast, all the reptiles sampled directly were present in the secondary data, which indicates the possible occurrence of over 137 species in the study area.

The 30 species of amphibians recorded are distributed in seven families, and the 14 species of reptiles are divided into four groups: amphisbaenians, caimans, lizards, and snakes. The record of the list of species encountered is attached to this document.

All four sample units visited had very similar wealth of species, and the area with the greatest number of amphibian and reptile species was the Absolute Reserve (RA), with 25 species, followed by UPA 07, with 24 species; UPA 14, with 22 species; and UPA 27, with 15 species. The area considered as “absolute reserve” (where no forest management intervention is planned) showed a greater wealth of species, and may eventually serve as the control area of the Farm. The list showing the presence of amphibian/reptile species detected in each sampled UPA is attached to this document.

Ichthyofauna

Because of the difficulty to acquire authorization to capture, collect and transport native wildlife specimens, it was not possible for the assessment to be made through primary data, thus the ichthyofauna (fish life) inventory was made only through the collection of secondary data. The data collected were a compilation of information available in the literature, such as journal articles, books, theses and dissertations, and also in digital databases. In this case the data for the municipalities of Porto Velho, Candeias do Jamari, Itapuã do Oeste, and Cujubim were considered, which are part of the Project’s Reference Region.

In all, 234 species were compiled for the Project’s Reference Region, present in the drainage of the Jamari river and the section of the Madeira river located within the Porto Velho municipal limits. This quantity of species is distributed among nine orders and 38 families. The composition of species reflects the pattern observed for the neotropical basins, in which there is a predominance of the orders Characiformes and Siluciformes (LOWE-MCCONNELL, 1999) and the highest representativeness of families Cichlidae and Loricariidae.

Through the secondary data collected, it was possible to observe that the region has the potential occurrence of a considerable number of species that make trophic and/or reproductive migrations (local names shown in parentheses): [*Leporinus* spp. ("piaus"), *Brycon* spp.("matrinchã"), *Prochilodus* spp. ("curimbas/curimbatás"), *Rhaphiodon vulpinus* e *hydrolicus* spp. ("peixes-cachorro"), *Brachyplatystoma vailantii* ("bagres"), *Zungaro zungaro* ("jaú"), among others]. It is worth noting that many of these species hold considerable commercial relevance to fishing communities on the Madeira river, a fact that highlights the importance of the project's reference region as local breeding/food potential for these fish in particular, and contribution toward maintaining inventories. Regarding the commercial importance, high-value species are identified, but that do not necessarily make great migrations, such as *Pseudoplatystoma fasciatum* ("surubim"), *Pirinampus pirinampu* ("barba-chata"), and *Sorubim lima* ("bico-de-pato").

The survey also indicates the potential occurrence of several species of small fish typical of smaller streams. These fish are noteworthy because of the greater sensitivity of the environments in which they occur, since smaller streams and the ecosystems present therein are more sensitive vis-à-vis human activity carried out in the riparian areas of these streams (HELFMAN, 2007).

The data collected were supplemented by interviews with workers of the Manoa Farm, whereby 37 species were mentioned (all of which were large sized species), which in a way underestimates the wealth of species, aside from not providing precise taxonomic information. However, the results of the interviews are shown to be valid by reinforcing the potential occurrence of species with commercial value, as well as species that make trophic/reproductive migrations. The list of species identified through interviews is attached to this document.

Finally, it is important to highlight that the data collected show that the streams present in the project area are in excellent condition and represent tremendous importance for harboring part of the migratory fish populations of the Madeira river. Thus, it is reasonable to infer that the project area has a high diversity of fish species, including representatives with high ecological importance, such as fruit/seed dispersers, foraging species and predatory species, as well as species with high economic significance.

Bird life

Data on bird life were surveyed from a compilation of secondary data inventories carried out in the surrounding Conservation Units (National Forests and Ecological Stations), plus a diagnosis performed in the Project Area through primary data collection. Based on the data collected in the Project

Area, it was possible to determine a species abundance index, the Point Index of Abundance ("IPA"), which is the quotient of the total number of contacts and the number of sample points (VIELLIARD et al., 2010).

During the ten days of sampling, 273 bird species were recorded, belonging to 22 orders and 53 families (attached hereto). Despite the large number, it is believed that new species might be recorded based on a larger sampling.

Compared to the secondary data collected, this total is considered representative, because it corresponds to 32% of those listed for the entire state of Rondônia (LEPAGE, 2015). Moreover, values of wealth are higher than the units listed in the protected areas in the immediate surroundings (DE LUCA et al., 2009; YAMASHITA et al., 2005; ICMBIO, 2010; FRANÇA et al., 2011).

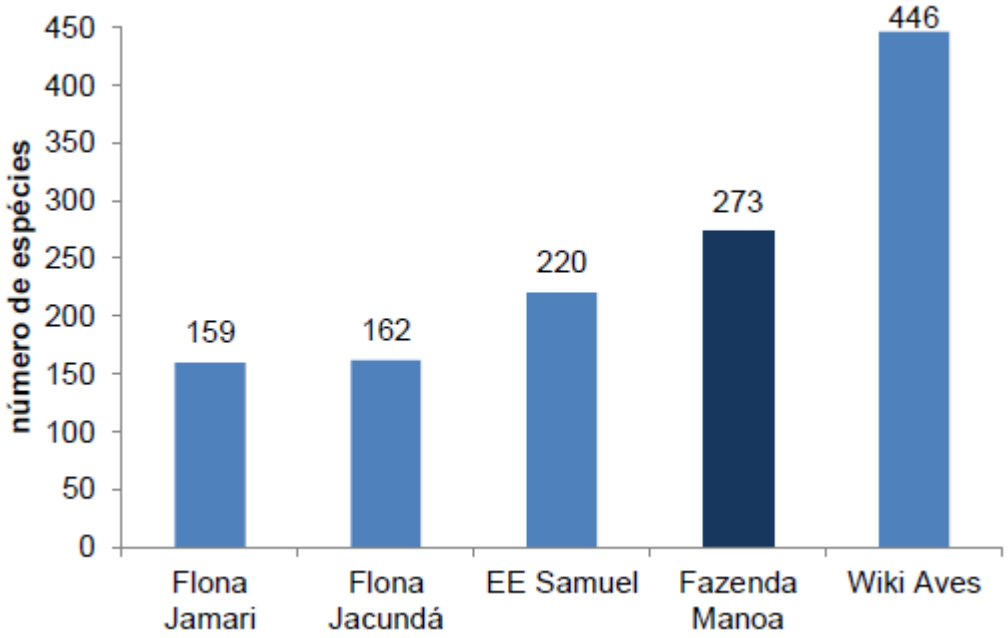


Figure 52 Wealth of bird life recorded in Estação Ecológica de Samuel (DE LUCA et al., 2009); Flona Jacundá (ICMBIO, 2010); Flona Jamari (YAMASHITA, 2005; FRANÇA et al., 2011), Project Area and records by observers in Cujubim, Candeias do Jamari, Itapuã do Oeste.

Few forest species recorded in the National Forests and Ecological Station were not detected during the observation period. They consist chiefly of high-mobility and extensive home range birds, and are less populous. In all and considering all the secondary data found (save for the Project area), 472

species were recorded. This great wealth detected is attributed to the extensive remaining forest area in the Project Zone and to the fact that the municipality of Porto Velho is cut by the Madeira river, which besides giving rise to unique environments is also a dividing line for a number of taxons. The lowland bio-geographical division created by Amazon region rivers gives rise to endemism areas, with the Project Area located in the region known as “Rondônia.” Among the species restricted to this division, the Project Area is the home of *Hypocnemis ochrogyna* (cantador-ocráceo), *Amazilia rondoniae* (beija-flor-de-cabeça-azul), *Rhegmatorhina hoffmannsi* (mãe-de-taoca-papuda) and *Lepidocolaptes fuscicapillus* (arapaçu-de-rondônia);

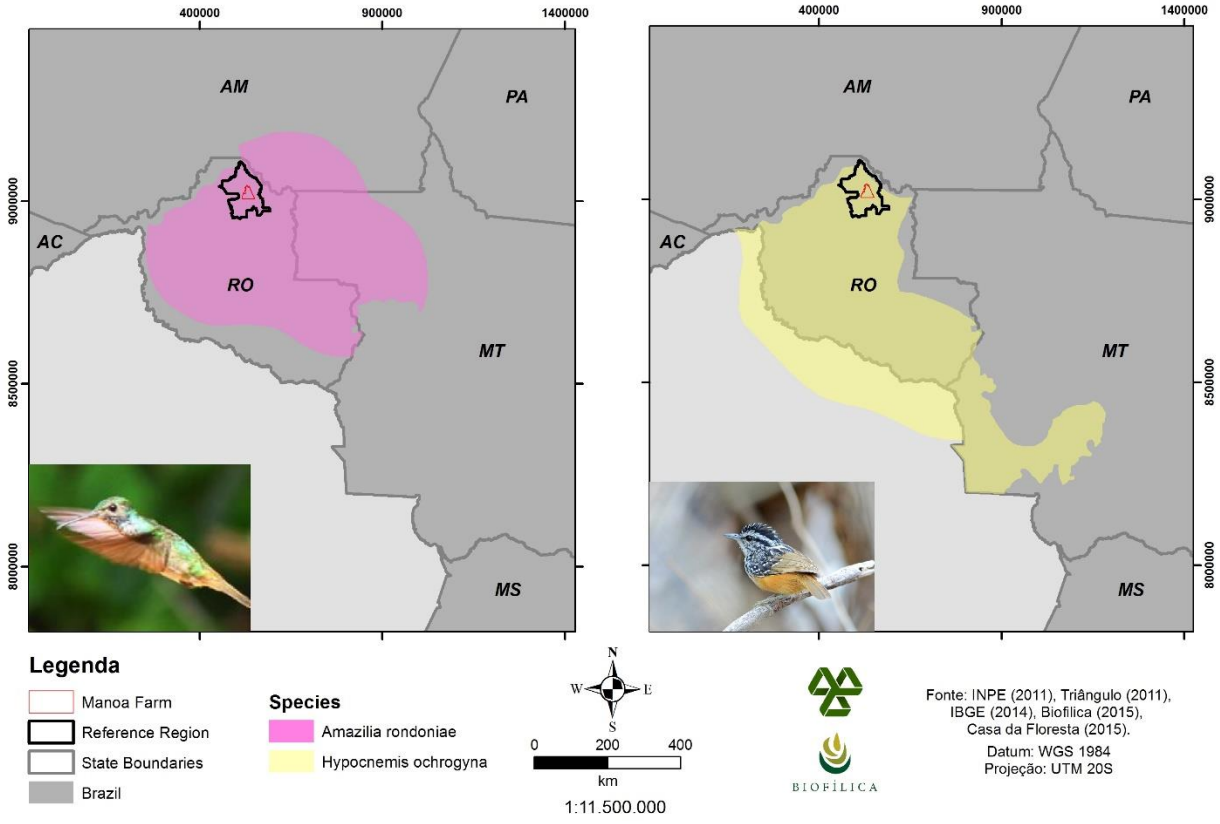


Figure 53 Map of restricted distribution species recorded in the Project Area.

Regarding bird life, the Amazon region’s endemism rating is divided into two zoo-geographic regions (South and North). Twenty species recorded were considered endemic in the Project Area’s

South Amazon region, all strictly forest areas. Despite this area being almost entirely located in an IBA (Important Bird Area), the Project Area itself displays features for being rated as such, as according to De Luca et al. (2009), at least 19 South Amazon region endemic species are required for inclusion in this category.

A Table 52 lists the nine species considered as endangered at a countrywide and/or global level, all in the Vulnerable (VU) class. Their chief threat is deforestation and the ensuing loss of the habitat's features, as being forest-dwellers that cannot withstand forest fragmentation. Moreover, many species are restricted in distribution and face the Amazon region's progressive deforestation, chiefly in the state of Rondônia, as is the case of the *Hypocnemis ochrogyna* (cantador-ocráceo), which in this case was highly abundant in almost all the UPAs surveyed. Besides being sensitive to fragmentation, the *Tinamus tao* (azulona) is restricted mainly to primary vegetation and is considered a target for hunters, which makes their populations fragile in the presence of human occupation (ICMBio, 2014). Parrot-like birds in turn are also vulnerable, as they are often hunted to serve unlawfully as pets due to their exuberant colors and their voice.

Table 52 Endangered bird species recorded in the Project Area.

Species (by Family)	Vernacular name	Endangered in Brazil	Endangered in IUCN
Tinimidae			
Tinamus tao	azulona	VU	VU
Psophiidae			
Psophia viridis	jacamim-de-costas-verdes		VU
Columbidae			
Patagioenas subvinacea	pomba-botafogo		VU
Ramphastidae			
Ramphastos vitallinus culminatus	tucano-de-bico-preto		VU
Psittacidae			
Pionites leucogaster xanthurus	marianinha-de-cabeça-amarela		VU
Pyrrhura perlata	tiriba-de-barriga-vermelha		VU
Pyrrhura snethlageae	tiriba-do-madeira		VU
Thamnophilidae			
Hypocnemis ochrogyna	cantador-ocráceo	VU	
Dendrocolaptidae			
Hylexetastes uniformis	arapaçu-uniforme		VU

Source: Adapted, Casa da Floresta (2015).

Recorded bird life is defined by the prevalence of species that depend on the forest (72%, n=198), many of which are very sensitive to changes in habitat (32%, n=87), i.e. cannot withstand fragmentation and deforestation. This fact is in agreement with the importance of the venue's forest preservation, to allow maintenance of bird life habitat.

In general, appropriate stewardship when exploiting timber appears to have little impact to the majority of bird species (WUNDERLE et al., 2006). Keeping forests intact is a means of preserving numerous forest taxons, and together with sustainable stewardship this avoids the main impacts that threaten the biome's bird life, such as hunting or fire, possibly caused by unlawful occupation or unauthorized roads.

Mammals

The Project Area's mammal inventory covered only medium and large species, i.e. those that weigh over 1.0 kg (BECKER and DALPONTE, 1991) including primates. In order to compare data gathered and bibliographical research, a previous survey took place of secondary data on mammals found in the project's zone of influence.

The wealth of species detected in the Project Area by gathering primary data resulted in a record of 43 large and medium-sized mammals that belong to 19 families, with Primates and Carnivores being the most numerous, with 12 and 11 species respectively (attached). Data gathered during studies held in areas surrounding the project area indicate the likely occurrence of 69 large and medium-sized mammal species, and the Manoa Farm was one of the richest areas, in connection with data gathered as well as the resulting inventory.

In Brazil the Amazon Forest holds the largest mammal diversity among neo-tropical biomes, with 399 species (PAGLIA et al., 2012), including in this list small flying and non-flying mammals. Considering only large and medium-sized mammal, the number of species is closer to 150, with primates (92) and carnivores (18) as the most representative groups (PAGLIA et al., 2012).

Please note the unprecedented and unexpected records that were not listed in the secondary data. One of these deals with *M. rondoni* (sagui-de-rondônia), a small new primate species described in 2010 (FERRARI et al., 2010), endemic in the state of Rondônia and already deemed to be endangered, probably due to its extremely restricted distribution.

Another record describes a rare South American canid, the *Atelocynus microtis*, found in the absolute reserve (RA) only. This is a lone omnivorous mammal, with a not well defined geographic distribution (PERES 1991); EISENBERG and REDFORD, 1999; LEITE-PITMAN and WILLIAMS 2011). (Figure 54). However, it is known that roughly 40% of its distribution is exactly in the deforestation region that concentrates the Amazon Forest's greatest distribution rates (LEITE-PITMAN e BEISIEGEL, 2013). According to Peres (1991) and Leite-Pitman & Williams (2011), records of its presence in fauna inventories are very uncommon. To date, what is known of the *A. microtis* ecology is that it seems to prefer forest environments with little or no changes (LEITE-PITMAN & WILLIAMS, 2011). Hence, detecting this species in the RA i.e. in the control area evidences its good state of preservation and increases the importance of caring for environments with greater forest integration.

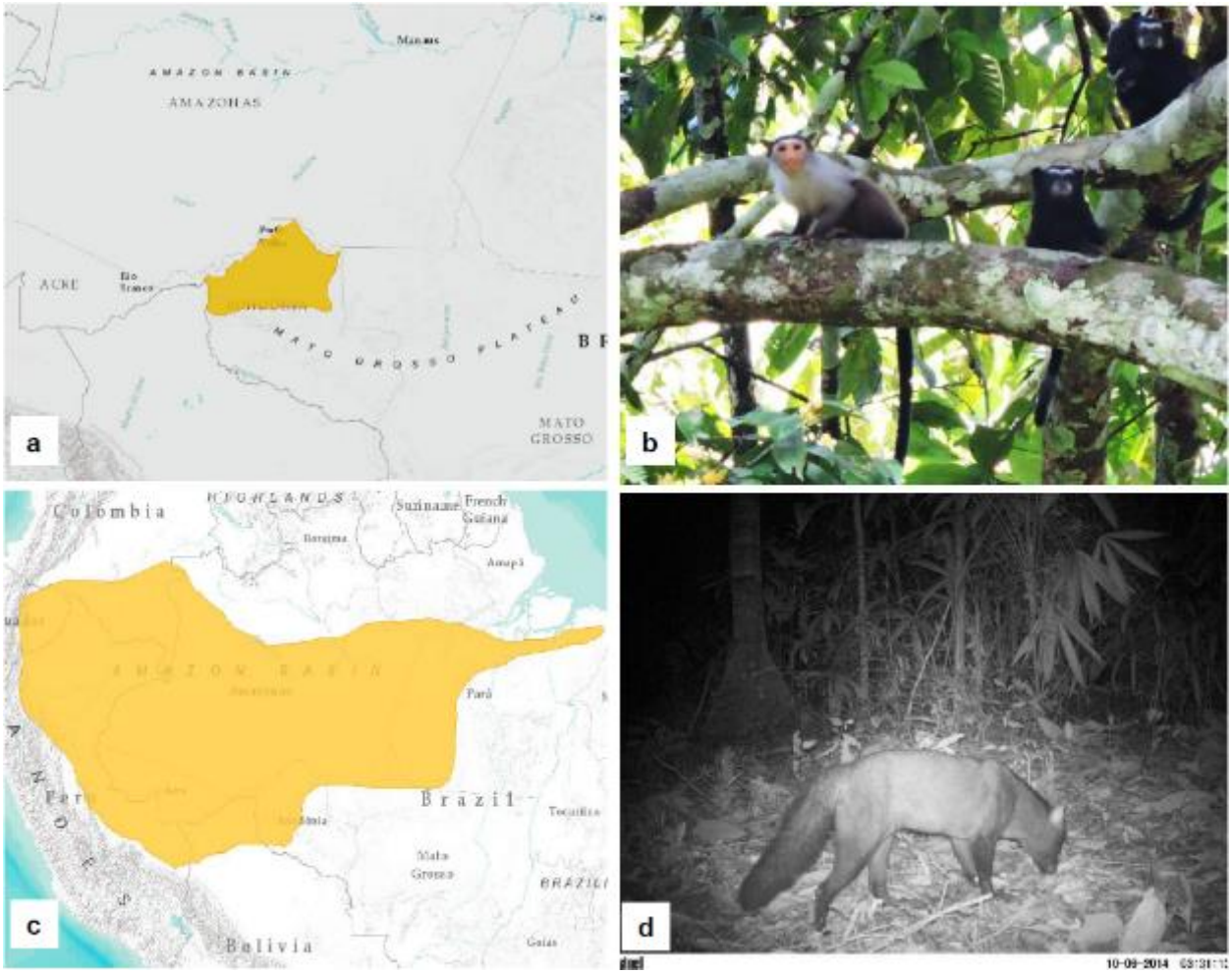


Figure 54 Source: Casa da Floresta (2015); Two unprecedented records in the project area. a. M. rondoni (sagui-de-rondônia) distribution map adapted from IUCN (2015); b. the primate's record in the project area; c. Atelocynus microtis (cachorro-do-mato-de-orelhas

Of the 43 species recorded, 12 are under a degree of danger according to international (IUCN, 2015) and/or domestic lists (IBAMA, 2014), which is equal to roughly 28% of medium and large mammals in the Manoa Farm (Table 53). Eight species are considered vulnerable (VU) to extinction by both lists, save for the *P. brasiliensis* (ariranha) and *Ateles chamek* (macaco-aranha), rated as endangered (EN) by the IUCN. The four remaining species: *Panthera onca* (onça-pintada), *Leopardus sp.* (gato-do-mato), *S. venaticus* (cachorro-vinagre) and *A. microtis* (cachorro-do-mato-de-orelha-curta), are endangered only in the Brazilian list, in the vulnerable class. Please note that of mammals at risk as a whole, one-half are in

the Carnivore order, and all are vulnerable to extinction in accordance with at least one of the lists adopted. In general, key threats to wild carnivores consist in habitat loss and fragmentation (COSTA et al., 2005), which change the environment and reduce areas available to the populations, as well as hunting, directly or indirectly through the reduction of prey available.

Table 53 Endangered large and medium-sized recorded in the Project Area.

ORDER/Family/*Species*	**Given Name**	**Endangered in IUCN**	**Endangered in IBAMA**
PRIMATES			
Atelidae			
Ateles chamek	macaco-aranha-de-cara-preta	EN	VU
Callitrichidae			
Mico rondoni	sagui-de-rondônia	VU	VU
CARNIVORES			
Felidae			
Panthera onca	onça-pintada		VU
Puma concolor	onça-parda		VU
*Leopardus sp.**	gato-do-mato	VU	VU/EN
Procyonidae			
Pteronura brasiliensis	ariranha	EN	VU
Canidae			
Speothos venaticus	cachorro-vinagre		VU
Atelocynus microtis	cachorro-do-mato-de-orelhas-curtas		VU
CINGULATA			
Dasypodidae			
Priodontes maximus	tatu-canastra	VU	VU
PERISSODACTYLA			
Tapiridae			
Tapirus terrestris	anta-brasileira	VU	VU
PILOSA			
Myrmecophagidae			
Myrmecophaga tridactyla	tamanduá-bandeira	VU	VU
ARTIODACTYLA			
Tayassuidae			
Tayassu pecari	queixada	VU	VU

*May be equal to the *Leopardus tigrinus* or *L. wiedii* species
Source: Adapted, Casa da Floresta (2015).

Among the species with a greater relative incidence, *Tapirus terrestris* (anta) and *P. onca* (onça-pintada) have a 67% and 17% relative incidence respectively. *Tapirus terrestris* is deemed a great spreader of seeds and it feeds on at least 39 plant species and in many cases it is the only spreader. Discrepancy in relative incidence found for the latter in relation to other species is due mostly to records obtained in the salt lick, representing roughly 90% of total records. The jaguar is the largest feline in the Americas and is at the top of the food chain. It has a low birth rate and needs extensive living space (CHEIDA et al., 2011), characteristics defining it as a species with high ecological requirements in terms of habitat and diet (CASO et al., 2008). However, the moderate frequency of records obtained during the inventory process enable it to be inferred that the Project Area concentrates important attributes for the specie.

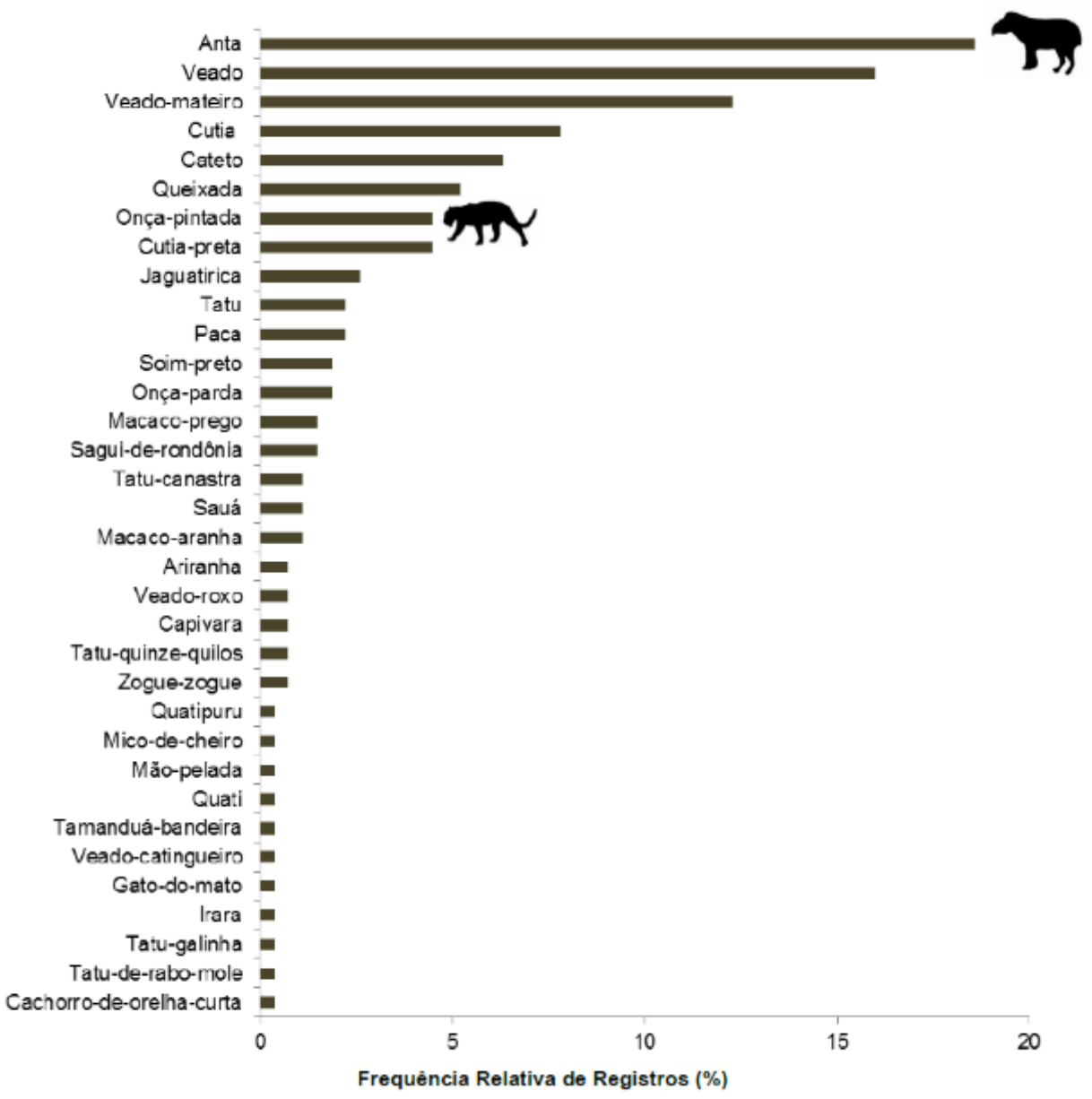


Figure 55 Source: Casa da Floresta (2015). The Relative Frequency (%) is calculated based on the number of large and medium size mammals in the Project Area. To improve visualization, the bar related to the number of tapirs recorded (Tapirus terrestres) has been.

Taking into consideration the areas where data concerning large mammals were collected (Areas in the process of being managing, already managed and absolute reserve), it was possible to observe that management operations did not result in a direct impact on the distribution and number of species so much so that there was a balance among the values of the wealth observed in all areas.

The results arising from the biodiversity inventory enabled recognition and characterization of the medium and large size mammal population present in the Project Area and in the remaining surrounding forests and served to illustrate the reality at the time in each one of the sample areas assessed. However, to be able to evaluate the impact of the management operations more precisely, as well as other impact factors related to the project's activities in relation to the large and medium size animal life, a greater period to evaluate and monitor the area would be necessary. Therefore, it would be necessary to conduct constant monitoring so that the possible impacts and changes in the local ecological parameters can be determined.

7.1.3 High Conservation Value Attributes

The forests have environmental and social values as a habitat for wild life, protection of water basins as well as supply of essential ecosystem type services. The forests where these values are considered to be of an exceptional nature or of critical importance can be defined as High Conservation Value Forests – HCV (JENNINGS et al., 2003).

When the biodiversity evaluation was being conducted in the Project Area, a salt lick area was identified, which could be classified as a "High Conservation Value Area" and presents significant importance for the maintenance of the local biodiversity.

The salt licks or clay pits are located in the midst of native vegetation, generally near water ways with little vegetation and exposed soil, rich in macro and micro nutrients (COELHO, 2006) (Figure 56). The salt lick soil is very rich in magnesium, calcium, phosphorous, boron and copper (MONTENEGRO, 2004), although its composition varies depending on the location (VARANASHI, 2014).

The locations are used by many animals, especially mammals and particularly herbivores, frugivores (BLAKE et al., 2011) and omnivores (KLAUSS et al., 1998), that practice geophagia i.e., they ingest the soil. The consumption of soil in these areas has been attributed to its several functions to the animal communities such as: a source of essential nutrients for foraging species (REDMOND, 1982; RUGGIERO e FAY, 1994); for detoxification of existing secondary vegetation origin compositions

(SOUZA et al., 2002); and may serve as a food source in times of resource scarcities (HEYMANN and HARTMANN, 1991; MOE, 1993).

Figure 56 Salt lick or clay pit evaluated in the Project Area.

The salt licks could also cause environmental costs associated with the expenditure of energy that the species need to dislocate to the specific location to obtain their dietary supplements (KLEIN and THING, 1989). Additionally, there is also an increased chance of predation (MATSUBAYASHI et al., 2006), and a risk of transmission of parasites and diseases by means of the species who frequent the locations (HENSHAW and AVENI, 1977). Nevertheless, the benefits the salt licks provide the animal population appear to outweigh the costs (KLAUS et al., 1998), since the salt licks are one of the few locations in the forest where it is possible to observe a high density of animals with greater frequency (VARANASHI, 2014).

The salt lick evaluated is found in the Permanent Preservation Area (Área de Preservação Permanente - APP) and is already protected under the New Brazilian Forestry Law (Law No. 12.727, of 2012), since this law determines that rivers ranging from 10 to 50 meters, from the edge of the river bed border, have a 50-meter minimum swath of vegetation (in which the salt lick in question can be classified, since the Rio Preto is approximately 35 meters wide). However, this measure does not appear to be entirely effective in its protection. In studies on the effects of the border on the communal vegetation, Chen et al., (1995) affirm that the influence of the effect of the river edge extends for a distance equal to two or three times the height of the canopy. Laurance et al. (1998) have indicated that the majority of the effects of the river bed edge is greater than 100 meters inside the vegetation. Intensification of the effect of the border changes the local ecosystem, altering the micro climate, increasing luminosity and causing the air to dry in addition to enabling more common species to enter (METZGER, 2010).

Therefore, based on studies that measure the minimum distance to prevent interference in a forest habitat, it is recommended to minimize the impacts caused by forest exploration to the salt lick, that management not be conducted at a distance of under 100 meters, thereby establishing a buffer zone against any impacts on the fauna that use the location, even if the species recorded are highly mobile.

According to that known of the new areas for inventory and exploration, other salt licks could be found distributed throughout the Project Area. In the event that such new salt licks be identified, they should be mapped and protected.

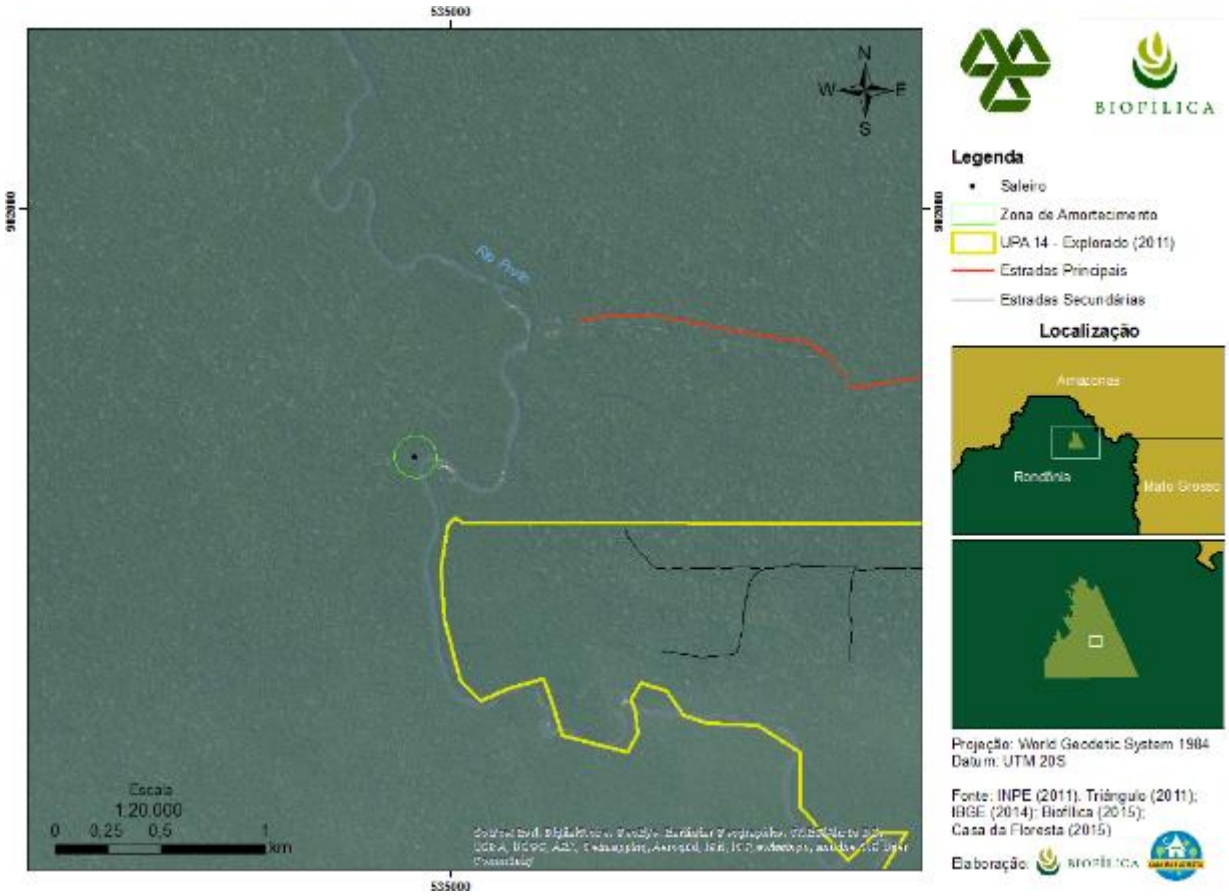


Figure 57 Map of the salt lick location inside the project area.

For the purpose of conducting a preliminary assessment of High Value Attributes for Conservation, the document “Assessment, Management and Monitoring of High Conservation Value Forest” was used: A practical guide for forest managers” produced by Proforest. Table 54 represents an adaptation of the assessment model suggested by Proforest and indicates the parameters identified and the respective justifications for the AAVC (High Conservation Value Attributes).

Table 54 Initial identification of the high conservation value attributes.

Value	Present	Potential	Absent	Justification
HCV 1 – Areas containing significant concentrations of biodiversity values, be they, on a global, regional or nation scale (e.g., endemism, endangered species, refuge).	X			As shown in items 7.1.1 and 7.1.2, there is one species of flora that is threatened (EN), one in critical danger (CR) and six that are vulnerable (VU). In relation to fauna, there are two species that are threatened (EN), one in critical danger (CR), and 21 are vulnerable (VU). The project zone, in addition to comprising a large part of the Rondônia State endemism zone, is made up of a mosaic of Conservation Units that encompass a broad focus on biodiversity conservation. The presence of the salt lick in the Project Area should be emphasized.
HCV 2 – Significantly large scale areas, be they on a global, regional or national scale, where the majority of the viable populations of certain species, if not all, occur naturally along normal distribution and abundance standards.			X	Despite the importance of the Project Area as a large area of biodiversity and ecological corridor, the locale does not present greater or unique relevance in relation to the total forest mosaic which comprises the region's Conservation Units.
HCV 3 – Areas that are or are contained within rare and/or threatened ecosystems.		X		The presence of the salt lick is remarkable in that it is regarded as a habitat with a concentration of endemic and endangered species and owed to the fact that it is a rare ecosystem attribute.

7.1.4 Future scenarios for biodiversity in the absence of the project

The probable scenarios for biodiversity can be foreseen upon a conjoint analysis of initial conditions for biodiversity in Project Area or in its influence area. In addition to that, these initial conditions can be related to future projections of deforestation for a scenario without a project, considering that the advance of deforestation is directly related to impacts in biodiversity.

In the regional context, the Project Area is a private area in a mosaic of units of conservation that are suffering from threats to maintain biodiversity in the last decades. These areas contain a degradation history related to wood stealing, invasion, illegal possession of island, among other activities, so despite of protection determined by law, security and surveillance of these areas are extremely fragile and these enable illegal activities.

Future impacts of biodiversity in a scenario without a project include loss of restrict species, habitat loss, loss of connectivity and ecosystem services. In addition such impacts, studies and monitoring of biodiversity that did not occur due to loss of project incentive can be included.

Loss of connectivity and, consequently, loss of habitat for species are directly related to the advance of deforestation, which can result in reduction of gene flow among population and that affects fauna displacement and propagule distribution (LAURANCE e VASCONCELOS, 2009). Forest fragmentation caused by deforestation may cause a drastic reduction in species richness which density and distribution is inferior in terms of small fragments and mainly affects specialist táxons (LAURANCE e VASCONCELOS, 2009) many of them are threaten, endemic or contain restrict distribution. The fact that there are species with restrict occurrence area in the region, as mentioned in survey of birds and mammals *(M. rondoni)*, indicates the importance to protect forest of the region.

According to Silva et al. (2005), the relation among these parts creates a huge system of resilient conservation, with great possibility to reduce future global changes, perform improvements in standard of living of local population and provide ecosystem services to population. In the same way, forest fragmentation results in opposite effects where the effects of edge that change the dynamic of fragments are mainly noted. They strongly affect forest micro climate, tree death and storage of carbon, fauna and other ecologic aspects (LAURANCE, 2011).

Projections of forest baseline in a scenario with no project indicate a total area of 126,685 hectare deforested for the first 10 years in Area of Project reference. In Project area the expectation is to have 1,547 deforested hectares in the same period, since the annual tax of deforestation showed for the

Reference area in the historic period was about 0.91%. The numbers indicate that in a scenario with no project, the biological richness of the area probably will not be maintained, since initiatives to preserve the area, such as creation of conservation units, were not so effective until now.

As evidenced by DeFries et al. (2005), deforestation around areas protected directly affects the quality of these areas and the ability to maintain its biological richness. This occurs mainly because of the isolation process caused as a result of no protection in these areas.

Finally, based on the conjoint analysis of quantitative aspects (deforestation projections) and qualitative (regional biodiversity study), it is possible to evidence that the future scenario (without a project) of biodiversity tends to be worst than the one presented in the beginning of the project. Once deforestation scenario tends to be the same in the future *(business as usual)*, studies show that biodiversity scenario tends to get worse due to the effects of forest fragmentation.

7.2 Net positive impacts in biodiversity (B2)

The project area is a local with great importance to preserve biodiversity. During data collection, secondarily or in the field, biota was really rich and contained typical táxons and indicators of strong environment. There results are mainly related to maintenance of forest in vertical way due to good management practices. In addition to that, the great extension of Project area, when hunting does not occur (predatory or for subsistence) within its limits and the connectivity in other remaining, such as Conservation Units, contribute to a higher richness of species detected in the area.

Measures taken to adopt good management practices in the forest, such as maximum number of trees removed by hectare, turnover and latency period of production units, allowing future exploration (BARRETO et al., 1998) and pre exploratory planning to determine impacts (positive or negative) and its consequences on biodiversity (GARDNER, 2010). The possible negative impacts related to management refer to intervention performed in the forest and it can cause, among other impacts, soil compaction, damages to remaining forest and fauna displacement.

According to these results, even though they are in the beginning, forest management in Project area seems to cause few impact in biotic community. In addition to that, the project REDD+ aims to complement conservation activities already performed and contribute in a more efficient way to preserve local species and its ecosystem services. In addition to that, the project aims to assure socio-

environmental benefits, once its purpose is to reduce the impacts in Project zone and in Project area itself through activities reduce deforestation and protection and preservation of natural forests in the region.

It is not expected by the project the creation of invading species or to increase its population, it cannot, as well, use genetically modified microorganisms. Planting to regenerate or for richness is not allowed in forest management of the area and, in case it occurs, native species and the appropriate rules required by current certification must be in place.

Table 55 Frame containing the summary of initial evaluation of the impact in the project about biodiversity on Project area and in its surroundings.

Impacts	Potential impacts on biodiversity in Project zone	Potential impacts on biodiversity out of Project zone
Positive	• Maintenance of biodiversity levels and conservation status of flora and fauna species; • Maintenance of rare and endemic species; • Preservation of attributes with high value of conservation; • Maintenance of key resources for species	• More awareness of biodiversity awareness in the region; • Increase of connectivity with other conservation units and other forest areas;
Negative	• Possible impacts resulted from activities of forest management in Project area	• Increase of request for hunting and fishing near the Project area (information leakage about activities)

7.3 Impacts on biodiversity out of project zone (B3)

As indicated in Table 55, information leakage of illegal hunting and fishing performed by external agents is considered a probable negative impact out of the project zone, once the conservation of this area would not allow these agents to acts inside the limits of the project and would make them migrate to another place.

Project area contains an important regional role in biodiversity because it comprehends deforestation and degradation and also because it is inside the mosaic of conservation units. Thus, the

maintenance of this habitat helps the conservation scenario and the relation with other forest aspects in the surroundings, not to mention that is has the potential to call the attention for scientific surveys in the local and to promote courses related to management and forest conservation.

By analyzing the regional context of the project, the potential benefits surpass the possible impacts generated by leakage of predatory activities, so these impacts can be reduced through activities implemented the project area.

7.4 Exceptional benefits for biodiversity (GL3)

7.4.1 Vulnerability

As mentioned in previous sections, according to environmental diagnosis performed in project area, IUCN Red list, and Brazilian Red List of Threatened Species (ICMBio), Project area receive regularly threatened or vulnerable species. Some endemic species in the region and considered vulnerable can be classified as a trigger to fit in Project area as “Key area for biodiversity”. Among these species are *Mico rondoni* (Rondon's Marmose), *Hypocnemis ochrogyna* (Rondônia warbling antbird), *Ateles chamek* (Black spider money), *Pyrrhura perlata* (Crimson-bellied Parakeet), *Pyrrhura snethlageae* (Madeira conure) and Tayassu pecari (White-lipped Peccary).

Rondon's Marmose was first described in 2010 and it is considered threated (VU) probably because it is an extremely restrict animal so, according to its geographic localization provided by IUCN, this specie is totally dependent on the remaining forest coverage in project zone. The Black spider monkey is classified as in danger (EN) by the IUCN. It appears in primary or with low index of noise tropical forests and uses, preferably, high trees (VAN ROOSMALEN, 1985), so it is extremely sensitive to deforestation impacts. The Madeira conure and Crimson-bellied Parakeet (Figure 58) are other examples of threated species that fit in vulnerable category (VU), according to IUCN list and that were seen in great number in the area.

Figure 58 Threatened Parakeets registered in the salt area: a. madeira conura (Pyrrhura snethlageae); b. Crimson-bellied Parakeet (P. perlata).

7.4.2 Recent population trends

In the case of M. rondoni, there is a decrease in population tendency, mainly because its geographic distribution is extremely restricted. Few studies were performed, so there is little information about how rare this specie is. An important characteristic identified was the probable association with other small size primate specie: *Saguinus fuscicollis* (Saddleback Tamarin). According to Ferrari et al. (2010) this is a ecologic characteristic of this specie and can be used as a key factor to determine how rare it is and the absence of Rondon's Marmose in some places.

Regarding Black spider monkey, studies revealed an estimative of decrease in its population in at least 50% in the last 45 years, mainly due to activities of hunting and loss of habitat (IUCN, 2008). According to IUCN (2008), the population tendency of species is to decrease in relation to the actual

scenario, mainly due to degradation of its natural habitat occurred by the advance of agricultural borders on native forest.

Hypocnemis ochrogyna specie, also popularly known as Rondônia warbling antbird, is not classified as vulnerable, according to IUCN list. According to some IUCN criteria, this specie presents great number of distribution and suffered a reduction of its population in less than 30% in the last 10 years and, for this reason, is not considered vulnerable specie. However, this specie is considered vulnerable in Brazilian Red List of Threatened Species (ICMBio) because it is an endemic specie and appears mostly in Rondônia state and great part of native forest in distribution area is within the limit called “Arc of Deforestation” in Amazon.

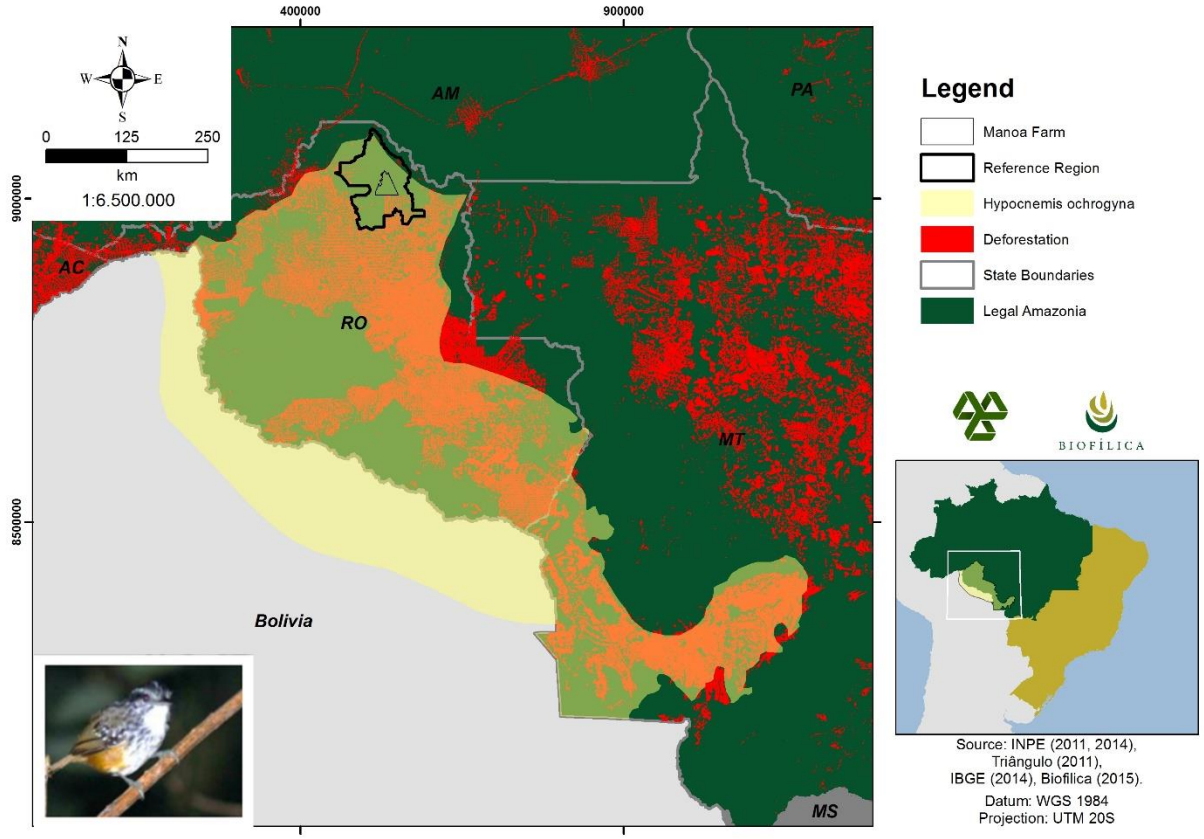


Figure 59 Distribution of Hypocnemis ochrogyna (Rondônia warbling antbird) surpassing deforestation in Amazon until 2014 (PRODES, 2014).

Birds belonging to Pyrrhura snethlageae specie (Madeira conure) and *Pyrrhura perlata* (Crimson-bellied Parakeet) are species of threatened parakeets and classified as vulnerable (VU) (IUCN, 2015) and were registered with high concentration in salt area: According to IUCN, Madeira conure presents a restrict distribution area, mainly in Rondônia, south of river Madeira. Its population is decreasing in the last decades and with decrease superior to 30% in the last three generations. Crimson-bellied Parakeet presents a distribution area less restrict in relation to Madeira conure and its population is considered stable in the last decades, however, it can be found in “Belt of deforestation” in Amazon. This fact provides vulnerability for the future species.

7.4.3 Project measures to improve conditions for species population

Project REDD+ Manoa intends to act mainly in habitat maintenance of species in the project area and to reduce and control threatens suffered by biotic community through project activities described in item 2.2 Description of Project activities.

Data from survey related to biodiversity were satisfactory once it assessed the current context to preserve biodiversity on Project zone, in its surroundings and focused on Project area, however, longer studies are required to explain variations that occur in biotic community along with forest modifications, whether they come from decrease of forest area in Project area and outside of the farm, climate changes or management activities, so its dynamic can be better understood (HENRIQUES et al., 2003).

Thus, to improve population condition of species, the project intends to prepare a fauna and flora monitoring plan to have a better knowledge of biota in the region. The purpose is to maintain local richness and of species threatened for preservation (trigger) and attributes of high value conservation (HCVs).

7.4.4 Monitoring and indicators for GL3

More details in Item 8. Monitoring, this document.

8 MONITORING

8.1 Description of the monitoring plan (CL3, CM3 & B3)

The monitoring plan of project REDD+ will provide information on three components: climate, community and biodiversity. As proponent and implementing partner of this project, Biofílica will coordinate monitoring processes during this project. Climate aspects will be monitored directly by Biofílica team. Social and biodiversity aspects will be monitored by Ecoporé and its partners experts in the area.

8.1.1 Climate impacts monitoring plan

Climate impacts monitoring plan will contain essential aspects to prove reduction of emission due to deforestation and degradation due to deforestation not planned and avoided (according to methodology applied VM0015) and changes in carbon stock during the project resulting from changes in the use of land in project area and in belt of leakage.

Part 1 - Application of methodology VM0015

1. Task 1: Monitoring of changes in carbon stock and GHG emissions for periodic checks.

1.1. Monitoring of current changes in carbon stock and GHG emissions within project area.

a) Technical description of monitoring tasks

Monitoring of changes in carbon stock and GHG emissions within the project area will be performed through deforestation monitoring not planned and avoided. Monitoring of the efficiency of REDD+ activities that aim to avoid deforestation not planned will be developed by Biofílica through the monitoring of such areas of forest coverage by satellite images and field check in project area.

b) Data to be collected:

Table 56 Data to be collected by the monitoring of changes in carbon stock and GHG emissions for periodic checks

Data/Parameter	Description	Unit	Source	Frequency
$Ctot_{icl}$	Average carbon stock of all accounted carbon pools in forest class *icl*	$tCO2eha^{-1}$	Calculated according to allometric equations and data measured in the field.	Collected in periods of up to 10 years.
$APDPA_{icl,t}$	Areas of planned deforestation in forest class *icl* at year *t* in the project area	Hectares (ha)	Calculated through remote sensing images, technical maps and data, field information and post exploratory of management.	Annual
$\Delta CPLdPA_t$	Total decrease in carbon stock due to planned logging activities at year *t* in the project area	Tons of equivalent carbon dioxide (tCO2-e)	Calculated	Annual
$ACPA_{icl,t}$	annual area within project area affected by catastrophic events in category *icl* in year *t*.	Hectares (ha)	Calculated through remote sensing images.	Whenever a catastrophic event occur.
$\Delta CUCdPA_t$	Total decrease in carbon stock due to catastrophic winds in year *t* in project area.	Tons of equivalent carbon dioxide (tCO2-e)	Calculated	Whenever a catastrophic event occur.
$AUFPA_{icl,t}$	Areas affected by forest fires in class *icl* in which carbon stock recovery occurs at year *t*	Hectares (ha)	Calculated through remote sensing images.	Whenever a forest fire event occur.

Data/Parameter	Description	Unit	Source	Frequency
$\Delta CUFdPA_t$	Total decrease in carbon stock due to unplanned forest fires at year *t* in the project area	Tons of equivalent carbon dioxide (tCO2-e)	Calculated	Whenever a forest fire event occur.
$\Delta CUDdPA_t$	Total of current change in carbon stock due to deforestation planned and not avoided in year *t* in project area.	Tons of equivalent carbon dioxide (tCO2-e)	Calculated	Annual
$\Delta CPSPA_t$	Total project carbon stock change within the project area at year *t*	Tons of equivalent carbon dioxide (tCO2-e)	Calculated	Annual

c) Summary of procedure to collect data

Monitoring of changes of use and land coverage:

The project intends to use the data processed by PRODES as a basis for the Monitoring, the main steps for the data collection and processing procedure carried out by PRODES are:

- Selection of satellite optical images with less cloud coverage and date of collection close to dry season in Amazon and appropriate radiometric quality;
- Geo referencing of satellite images with topographic maps in scale 1:100.000 or images from NASA from MrSID in orthorectified format;
- Creation of a model with spectral mixture of percentage of vegetation, soil, shade component for each image pixel;
- Application of the technique for segmentation that identifies spatial adjacent regions (segments) in satellite images with similar spectral features;
- Classification of segments to identify forest categories, nonforest vegetation and deforestation.

Monitoring of carbon stock and emission on non CO2:

Monitoring of changes (reduction) in carbon stock will be performed through forest inventory, measure of diameter to chest height (DBH = 130 cm) for each tree with DBH higher or equal to 15 centimeter within parts of forest inventory. DBH is the main variable used to stimulate carbon stock and changes in carbon stock in project REDD+ Manoa.

d) Procedures to control and guarantee quality

Monitoring of change of use and land coverage:

In order to validate the information obtained from the PRODES mapping, the mapped occurrence of deforestation information will be checked through high resolution images and data collected in the field with a navigation GPS when necessary. The minimum accuracy in land use and land cover classification should be 80%. For cloud-covered areas, SAR sensor images such as RADRSAT-2, Cosmo SkyMed or TerraSar-X will be used.

Original digital data (raster) and processed (vectors) of satellite, coordinated images, technical maps, photos and field tab will be stored by Biofílica Investimentos Ambientais during the project. Maps with infrastructure installed, satellite images and reports on deforestation will be available for verification in each verification event.

Monitoring of carbon stock and emissions on non CO2:

The procedure to control and guarantee forest management quality is conducted by Triângulo in preharvesting inventory phases, during and after harvesting. Biofílica will have access to reports and original field tabs. It will have a copy of these documents during project life cycle. Inventory spreadsheets and reports and monitoring of remaining parts will be available to the verification body at each verification event.

e) Data archive

All data and report produced by REDD+ Manoa project will be stored by Biofílica Investimentos Ambientais though digital files during project life cycle. Original reports (physical) and field tabs produced by forest management activity will be stored by Triâgulo. Biofílica Investimentos Ambientais will keep a copy of these documents in digital format during the project. All documents related to project monitoring will be transformed in physical files and/or virtual and will be available to the verification body at each verification event.

f) Organization and responsibilities of parties involved in description above

These activities are Biofílica Investimentos Ambientais responsibility.

1.1.1. Monitoring of Project implementation

Implementation of REDD+ activities will be monitored through financial spreadsheets, performance and quality reports, social management reports, vegetation coverage maps, meeting reports, invasion occurrence report and other relevant documents.

1.1.2. Monitoring of changes of use and land coverage within project area

The monitoring of planned and unplanned deforestation will be carried out through data provided annually by PRODES (INPE), which uses satellite images with a spatial resolution of 30 meters. Subsequently the mapping will be validated from the assessment of accuracy with high resolution images and field verification when necessary. Deforestation monitoring to implement infrastructure of social activities will be performed through specific field tabs and, to build roads, tracks and yards for storage within the project area, Pre exploratory reports, maps and satellite images containing information of forest coverage area converted in nonforest category will be used. Aiming for greater flexibility in the deforestation mapping process, different techniques for classification and visual interpretation can be used during project progress, such as complementary mapping using alternative images and sensors and data collected in the field.

Data related to deforestation events will be compared to baseline scenario. Values of emissions reduced during deforestation period will be based according to comparison between foreseen and actual deforestation.

1.1.3. Monitoring of changes in carbon stock

Within project area:

It is expected that the ex-ante estimative of carbon stock according to forest classification does not change baseline period. However, Methodology VCS VM0015 requires monitoring of carbon stock in project area to be subjected to a significant loss of carbon stock in project, according to ex ante assessment, due to controlled deforestation and management planning activities or areas subjected to reduction not planned and important to carbon stock in baseline.

Total change in carbon stock due to not planned deforestation not avoided within project area is calculated as follows:

$$\Delta CUDdPA_t = \sum_{y=1}^{t}\left(\sum_{icl=1}^{icl} AUDPA_{icl,y} * \Delta Ctot_{icl,t-y} - \sum_{fcl=1}^{fcl} AUDPA_{fcl,y} * \Delta Ctot_{fcl,t-y}\right)$$

Where:

$\Delta CUDdPA_t$ Total change in carbon stock due to not planned deforestation not avoided within project area in year t.

$AUDPA_{icl,y}$ deforestation area not planned in initial icl forest category in year t within project area in project scenario.

$\Delta Ctoticl,_{Ac}$ Loss of carbon stock in initial icl forest category during changes AC (# of years after change LU/LC).

$AUDPAfcl,_y$ non forest category area fcl in time t within project area after deforestation not planned in project.

$\Delta Ctotfcl,_{Ac}$ Gain of carbon stock in final fcl non forest category during changes AC (# of years after change LU/LC).

In case there is an important reduction in carbon stock due to sustainable forest management activities, such reduction will be reported during verification process through table 29 of Methodology VCS VM0015 version 1.1.

Within areas of leakage management:

Areas are not subjected to planned loss of carbon stock in areas of leakage management in the project.

Monitoring of non CO2 emissions resulted from forest fire:

Emissions resulted from biomass burn will not be considered in this project.

1.1.4. Monitoring of natural disturbance impacts and other catastrophic events

Loss in carbon stock and increase in GHG emissions due to natural disturbances or catastrophic events will be controlled through monitoring of forest coverage via satellite by using the same methods applied for monitoring forest coverage in project area (section 1.1.2).

Main activities to be developed to collect and process data:

- Selection of satellite optical images with less cloud coverage taken during dry season in Amazon and with appropriate radiometric quality;
- Geo referencing of satellite images with topographic graphics in scale 1:100.000 or images from NASA in MrSID in orthorectified format;
- Mapping of affected forest coverage areas.

Emissions resulted from natural disturbances or catastrophic events will be estimated by multiplying the area of forest loss mapped by the average of forest carbon stock. In case there is an important reduction in carbon stock due to natural disturbances or catastrophic events, such reduction will be reported in processes of verification by using tables 25e, 25f and 25g of methodology approved VCS VM0015 version.

1.2. Leakage Monitoring

a) Technical description of monitoring tasks:

REDD+ Manoa project evolves two activities of leakage source monitoring:

I. The monitoring of reduction of carbon stocks and/or increase of GHG emissions associated to measures to prevent leakage if project proponents implement activities such as planting of trees, agricultural intensification, fertilization, production of forage and/or other measures to improve agricultural areas and creation of cattle. Is these activities cause reduction on carbon stocks and/or increase in GHG emissions in leakage management areas, such changes in carbon stock and/or GHG emissions are estimated by Biofílica Investimentos Ambientais.

II. Monitoring of forest coverage in leakage belt through satelite images will be performed by Biofílica Investimentos Ambientais.

b) Data to be collected

Table 57 Data to be colected for leakage monitoring.

Data	Description	Unit	Source	Frequency
$\Delta CLPMLK_t$	Reduction of carbon stock due to measures to prevent leakage	tCO_2-e	Calculated	Annual
$EgLK_t$	Emissions resulted from animals on pasture in leakage management area in year t	tCO_2-e	Calculated	Annual
$ELPMLK_t$	Total annual increase of GHG emissions derived from measures to prevent leakage in year t	tCO_2-e	Calculated	Annual
$\Delta CabBSLLK_t$	Total change in carbon stock in belf of leakage area	tCO_2-e	Calculated	Annual

c) Summarized description of procedures to collect data

Monitoring of changes in carbon stock and GHG emissions associated to activities to prevent leakage

The main activities developed to collect and process data to monitor changes in carbon stock due to implementation of activities in leakage management areas are:

- Activities to prevent leakage will be listed;
- A map showing areas and type of intervention will be prepared;
- Areas in which activities to prevent leakage impact on carbon stock will be identified;
- Categories of nonforest existent within these areas will be identified;
- Carbon stocks in categories identified will be measured or literature estimative will be used;
- Changes in carbon stock in leakage management area in project scenario will be reported in table 30b of methodology VM0015;
- Liquid changes in carbon stock caused by measures to prevent leakage during the period established in baseline and the period of accreditation of project will be calculated;
- Results of calculation will be reported in table 30c of methodology VM0015.

Monitoring of carbon stock decrease and increase of GHG emissions due to leakage displacement:

Monitoring of changes in carbon stock

Procedure to collect data used will be the same applied in deforestation monitoring in project area (session 1.2).

Monitoring of increase in GHG emission

Emissions resulted from forest fire are not considered in baseline.

d) Procedures to control and guarantee quality

Monitoring of changes in carbon stock and GHG emissions associated to activities to prevent deforestation:

To be determined depending of activity, if implemented.

Monitoring of carbon stock decrease and increase of GHG emissions due to leakage displacement:

Procedure to control and guarantee quality used will be the same applied to monitor deforestation in project area (session 1.2).

e) Data archive

Original reports and field tabs will be stored by Triângulo. A Biofílica Investimentos Ambientais will keep a copy of these documents in digital format during the project life cycle. Original digital data (raster) and processed (vectors) of satellite T images, coordinated images, technical maps, photos and field tab will be stored by Biofílica Investimentos Ambientais during the project life cycle. Annual map of deforestation areas, satellite images and reports will be available for each body of verification in each event of verification.

f) Organization and responsibilities of parties involved in description above

These activities are Biofílica Investimentos Ambientais responsibility.

1.2.1. Monitoring of changes in carbon stock and GHG emissions associated to activities to prevent leakage.

Reduction in carbon stocks due to activities developed in leakage management areas is not expected, once none of the activities to improve agricultural techniques or management of pasture areas can change carbon stocks and increase GHG emissions when compared to baseline scenario contain the implementation required.

The following activities in leakage management area can, occasionally, cause decrease in carbon stock or provide addition to GHG emissions:

- Changes in carbon stock due to activities implemented in leakage management areas;

According to the most recent version of VCS Standard, nitrous oxide (N2O) emissions resulting from nitrogen fertilization are always considered insignificant. The consumption of fossil fuel is always considered as insignificant in activities of AUD project and should not be considered.

1.2.2. Monitoring of carbon stock decrease and increase of GHG emissions due to leakage displacement

Data of activities in the area of belt of leakage are determined through the same method applied to deforestation monitoring in project area (section 1.2). If a deforestation event greater

than expected in baseline scenario is noticed in belt of leakage during the monitoring process and such deforestation is related to deforestation agents in project area, the losses in carbon stock are considered and reported by using table 22c and 21c of methodology approved VM0015.

Total change in carbon stock due to not planned deforestation not avoided within the area of belt of leakage is calculated as follows:

$$\Delta CBSLLK_t = \sum_{y=1}^{t}\left(\sum_{icl=1}^{icl} AUDLK_{icl,y} * \Delta Ctot_{icl,t-y} - \sum_{fcl=1}^{fcl} AUDLK_{fcl,y} * \Delta Ctot_{fcl,t-y}\right)$$

Where:

$\Delta CBSLLK_t$ Total change in carbon stock due to unplanned deforestation not avoided within the leakage belt area in year t.

$AUDPA_{icl,y}$ deforestation area not planned in icl forest category in year t within leakage belt area in project scenario.

$\Delta Ctoticl_{,Ac}$ Loss of carbon stock in initial icl forest category during changes Ac (# of years after change LU/LC).

$AUDLK_{fcl,y}$ non forest category area fcl in time t within the leakage belt area after unplanned deforestation in project.

$\Delta Ctot_{fcl,Ac}$ Gain of carbon stock in final fcl non forest category during change Ac (# of years after change LU/LC).

1.2.3. Total estimated of ex post leakage

Results will be displayed to the body of verification in each verification event through table 35 of methodology VM0015.

1.3. Ex post liquid reduction of GHG gases

a) Technical description of monitoring tasks

In the verification process, the results will be displayed through table 26 of methodology applied VM0015 version 1.1 along with spatial data (deforestation map, when available).

b) Data to be collected

Table 58 Data to be collected to monitor ex post liquid reduction of GHG gases.

Data	Description	Unit	Source	Frequency
$\Delta REDD_{,t}$	Liquid reduction of anthropogenic emissions of GHG related to AUD activities of the project in year t	tCO2-e	Calculated	Annual
VCU,t	Number of Verified Carbon Units (VCUs) to be available for commercialization in time t	tCO2-e	Calculated	Annual

c) Summarized description of procedure to collect data

The number of Verified Carbon Units (VCUs) to be created by activities in project REDD+ Manoa in yeat t will be calculated through equations 19 and 20 of methodology approved VM0015 version 1.1.

d) Procedures to control and guarantee quality

All tasks and tools indicated in part 2 of methodology VM0015 will be used to assure that all data are appropriate to the process of verification and VCUs numbers are reliable.

e) Data archive

All data and report of project REDD+ Manoa project will be stored by Biofílica Investimentos Ambientais though digital files during project life cycle. All documents related to project monitoring will be compiled in physical files and available to the verification body at each verification event.

f) Organization and responsibilities of parties involved in description above

These activities are Biofílica Investimentos Ambientais responsibility.

2. Task 2: Reviewing future baseline projections to establish baseline

2.1. Updated information about agents, vectors and underlying causes of deforestation

Statistic and spatial data, studies and information about agents, vectors and underlying causes of deforestation required to perform steps 2 and 3 of methodology VM0015 will be updated and used to review projections in baseline after the period established of 10 years. When available, forest management monitoring data and other activities developed by the project will be used.

2.2. Adjustment of component of change and use and soil coverage in baseline

If a national or subnational baseline becomes available during the period established for baseline, that one will be applied in the following period. If a national or subnational baseline becomes available, step 4 of methodology VM0015 will be performed again, considering the period of 10 years (from 2013 to 2022) by using variables updated for agents, vectors and underlying causes of deforestation in the region of reference. The two main components to be reviewed are: annual area of deforestation and location of baseline deforestation.

Assumptions and hypothesis considered when framing future deforestation dynamics (socioeconomic data), just like data used in spatial projection (roads, locations and distance of new deforestation places updates) will be reviewed and updated.

2.3. Adjust in carbon component in baseline

The spatial estimate of carbon can be reviewed according to results occurred during changes in monitoring of changes in carbon stock, according to methodology VM0015 version 1.1, Part 3, item 1.1.3. During the project, new technologies and methodologies can be analyzed to biomass spatial estimate as, for example, LIDAR or SAR data.

8.1.2 Plan to start monitoring impacts in Community Groups and Other Stakeholders

The Monitoring Plan for the impact to the social actors involved contains in its essence process indicators and part of the outcome indicators. For the presentation of the full social monitoring plan, the plan presented here will be evaluated and validated by the stakeholders, the process and results indicators will be complemented and adjusted and the impact indicators will be established as the planned actions are put into practice.

Following the same strategic logic of the other proposed activities, the monitoring of social activities aims to access the effectiveness of the interventions described in item 2.2 Description of the Project Activities, through the Theory of Change. In this way, the Plan seeks to verify the positive and negative impacts generated by the project in the socioeconomic dimension, comparing actual impacts based on anticipated changes, in addition to making adjustments to the Plan through the analysis of possible negative impacts.

a) Data to be collected

Data and parameters to be collected are described in item 8.3 of this document.

b) Summary of procedure to collect data

The data will be collected during and after the activities and / or through specific interviews. Data collection will be carried out through questionnaires offered to participants in the activities, records written in meetings and in a complementary way, structured interviews will be conducted annually with the social actors participating in the training and seminars.

The annual evaluation of the actions carried out by the project will aim to identify the effectiveness of the interventions, seeking to capture changes generated by the project in the way the actors involved relate to the environment and practical applications in the day to day. This information will be systematized and presented through annual reports of social activities of the project, through the site of the proponents and in a specific devolutive meeting.

c) Procedures to control and guarantee quality

Data researched and reported will be shown and evaluated during the meeting with interested parties, to which all people interested in the project will be invited to participate.

d) Data archive

All data and report produced by REDD+ Manoa project will be stored by Biofílica Investimentos Ambientais though digital files during project life cycle. Original reports (physical), meeting minutes and field tabs produced will be stored by Triângulo and Ecoporé to perform social activities. Biofílica Investimentos Ambientais will keep a copy of these documents in digital format during the project. All documents related to project monitoring will be transformed in physical files and/or virtual and will be available to the verification body at each verification event.

e) Organization and responsibilities of parties involved in description above

Social monitoring activities are under Biofílica Investimentos Ambientais and Ecoporé responsibility.

8.1.3 Plan to start monitoring impacts to biodiversity

The monitoring plan aims at evaluating local community in relation to management and forest integrity practices. To fauna, it is planned to implement two annual campaigns; one per semester, such as presence of migratory species and reproductivity periods be implemented. To flora, the monitoring plan includes reduction of permanent parts within a period of 5 years to evaluate forest dynamics (recruiting taxes, mortality, substitution of species) and variations in carbon stock.

Regarding impacts on forest management, in terms of levels of disturbances to biodiversity, it was not possible to clearly determine the interference of management in local community. Such information can be clearly explained with long term management (HENRIQUES et al., 2003).

The evaluation of the effectiveness of the measures adopted to maintain and improve HCVs will be incorporated within these tasks since HCV1 is linked to the monitoring of species of relevance and HCV3 to the salt shaker.

a) Data to be collected

Data and parameters to be collected are in item **Erro! Fonte de referência não encontrada.** of this document.

b) Summary of procedures to collect data

Parameters related to impacts of project activities are annually monitored. Parameters related to fauna diagnosis are collected at least two times a year (summer and winter). This information is inserted in the system and presented through reports to monitor fauna related to one year of monitoring, before each verification event.

Relevant species data are collected during studies. This information is inserted in the system and presented through reports to monitor fauna related to one year of monitoring, before each verification event.

c) Procedure to control and guarantee quality

Procedures to control and guarantee quality that are related to data collection will depend on internal procedures of the company responsible for field survey in each study.

Survey based on ethnozoology will be displayed and validated during the meetings with interested parties and communities nearby will be invited to participate, within other members, to the whole life cycle of the project.

d) Data archive

All data and report produced by REDD+ Manoa project will be stored by Biofílica Investimentos Ambientais though digital files during project life cycle. Original reports (physical) and field tabs produced will be stored by the organizations responsible for the field survey and/or by Triângulo e Ecoporé. Biofílica will keep a copy of these documents in digital format during the project. All documents related to project monitoring will be transformed in physical files and/or virtual and will be available to the verification body at each verification event.

e) Organization and responsibilities of parties involved in description above

All monitoring activities are under Biofílica Investimentos Ambientais and other companies collaborating in biodiversity studies and Ecoporé responsibility.

8.2 Data and parameters available for validation

Unit of data/Parameter:	**Deforestation**
Unit:	Hectare (ha)
Description:	Maps of forest coverage area converted into areas with no forest coverage.
Source:	Measures through project PRODES/INPE data.
Value applied:	0,79%/year in average (2000-2012).
Justification of data chosen or description of means of measurement and procedures applied	To map deforestation and production of Mapa da Marca de Excelência de Cobertura Florestal (Map of Excellence of Forest Coverage) data of program PRODES Digital (Satellite of official mapping of deforestation of Brazilian Amazon) were used. A total of 48 Landsat images were used during the period analyzed. ISOSEG method of nonsupervised classification was used to classify images to map forest categories, nonforest vegetation, hydrography and deforestation.
Purpose of data:	• To determine baseline scenario • To calculate baseline emissions • To calculate project emissions • To calculate leakage
Comments	Check documents: • Câmara *et al*. 2006. *Metodologia para o cálculo da taxa anual de desmatamento na Amazônia Legal* • *Determinação da Linha de Base e Dinâmica de Desmatamento para o projeto Manoa*

Unit of data/Parameter:	***Ctot***
Unit of data:	$tCO_2e\ ha^{-1}$
Description:	Average of carbon stock per hectare in all carbon reservoirs in forest category used in baseline scenario.
Source:	Calculated according to allometric equations and data measured in the field.

Value applied:	513 tCO_2e ha^{-1}
Justification of data chosen or description of means of measurement and procedures applied	Estimates on biomass above and under soil were performed through forest inventory data and allometric equations developed in similar areas and project area (SILVA, 2007). Deadwood reservoir was estimated based on forest inventory data and Silva equations (2007).
Purpose of data:	• To determine baseline scenario • To calculate baseline emissions • To calculate project emissions • To calculate leakage
Comments	Check documents: Estimativa do Estoque de Carbono Florestal para o projeto REDD+ Manoa

Unit of data/Parameter:	**DBH**
Unit of data:	cm
Description:	Diameter to chest height (130 cm) for each tree with DBH equal or superior 15 cm in each part of the forest inventory
Source:	Measured in the field by Florestal Paisagismo
Value applied:	See spreadsheet with field data
Justification of data chosen or description of means of measurement and procedures applied	Requirement of Methodology VCS VM0015. Data of forest inventory collected in less than 10 years ago with multiple parts located in large spatial distribution
Purpose of data:	• Baseline scenario determination • Calculation of baseline emissions • Calculation of project emissions • Calculation of the leakage
Comments	Main variable to estimate carbon estimate

Unit of data/Parameter:	$BGB_{fw} = 0{,}0469 \text{x} DAP^{2{,}4754} \text{x} fc_1$ $AGB_{fw} = EXP(-1{,}716 + 2{,}413 \text{x} ln(\text{DAP}))$
Unit of data:	Kg (bioamass fresh weight)

Description:	Equation to convert DBH in fresh biomass
Source:	1. SILVA, 2007 2. Nogueira, 2008
Value applied:	1. $BGB_{fw} = 0{,}0469\text{x}DAP^{2{,}4754}\ \text{x}fc_1$ 2. $AGB_{fw} = EXP(-1{,}716 + 2{,}413\text{x}ln(\text{DAP}))$
Justification of data chosen or description of means of measurement and procedures applied	Equation developed for forest with characteristics similar to forests in the region of reference.
Purpose of data:	• Baseline scenario determination • Calculation of baseline emissions • Calculation of project emissions • Calculation of the leakage
Comments	

Unit of data/Parameter:	**CF**
Unit of data:	t
Description:	Content of carbon in dry biomass
Source:	Nogueira, E.; Fearnside, P.; Nelson, B., et al., 2008. Estimativas de biomassa florestal na Amazônia Brasileira: Novas equações alométricas e ajustes da biomassa dos inventários de volume de madeira. Forest Ecology and Management, 256 (11), pp.1853-1867
Value applied:	0,485
Justification of data chosen or description of means of measurement and procedures applied	Value found in scientific literature.
Purpose of data:	• Baseline scenario determination • Calculation of baseline emissions • Calculation of project emissions • Calculation of the leakage
Comments	

Unit of data/Parameter:	**44/12**
Unit of data:	tCO_2e
Description:	Carbon mass to factor of conversion of CO_2e mass
Source:	From scientific literature: 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 AFOLU.
Value applied:	44/12
Justification of data chosen or description of means of measurement and procedures applied	Standard value of IPCC
Purpose of data:	• Baseline scenario determination • Calculation of baseline emissions • Calculation of project emissions • Calculation of the leakage
Comments	

Unit of data/Parameter:	**Opening of area for management infrastructure**
Unit of data:	Percentage
Description:	Area available to build the infrastructure required in sustainable forest management activities such as yards, primary and secondary roads.
Source:	Post exploratory report and specialists opinion
Value applied:	1,6%
Justification of data chosen or description of means of measurement and procedures applied	Data are collected in field after harvesting activity. Post exploratory reports
Purpose of data:	• Baseline scenario determination • Calculation of baseline emissions • Calculation of project emissions
Comments	

8.3 Monitored data and parameters

Climate

Unit of data/Parameter:	**Deforestation of project area and belt of leakage**
Unit of data:	Hectare (ha)
Description:	Areas with forest coverage converted into areas with no forest coverage withing project area and belt of leakage in project REDD+ Manoa
Source:	Calculated based on remote sensing images along with GPS data collected in the field.
Description of measurement means and procedures to be applied.	The monitoring of forest coverage in project area and belt of leakage will be done through analysis of Satellite images. When data of PRODES system are not available, the forest coverage monitoring will be performed according to automatic classification and visual interpretation of other optic sensors images or SAR data.
Frequency of monitory/registry:	Annual
Value applied:	N/D
Equipment for monitoring:	Remote sensing images of digital processing program, systems of geographical information and navigational GPS.
GQ/CQ procedures to be applied:	Images with special resolution of 30 m or more will be used in mapping. The minimum mapping unit is 1 ha. Classification evaluation will be performed through data collected in field by using GPS navigation. The minimum precision of classification map of soil use and coverage is 80%.
Method of calculation:	If not planned deforestation areas are detected, the Map of Excellence of Forest Coverage will be updated according to maps algebra.
Comments	PRODES Digital project: http://www.dpi.inpe.br/prodesdigital/prodes.php More information on control and quality assurance available in: (CÂMARA et al., 2006). *Metodologia para o cálculo da taxa anual de desmatamento na Amazônia Legal*

Unit of data/Parameter:	***Ctot***
Unit of data:	$tCO_2e\ ha^{-1}$
Description:	Average of carbon stock per hectare in all carbon reservoirs in forest category used in baseline scenario.
Source:	Calculated according to allometric equations, expansion factor of literature and data measured in the field by Florestal.
Description of measurement means and procedures to be applied.	Estimates on biomass above and under soil will be performed through forest inventory data and allometric equations developed in similar areas and project area (Silva, 2007 and Nogueira, 2008).
Frequency of monitory/registry:	Data of forest inventory collected in up to 10 years period in multiple parts.
Value applied:	N/D
Equipment for monitoring:	N/D
GQ/CQ procedures to be applied:	Mandatory monitoring, according to Methodology VM0015. Data of forest inventory collected in up to 10 years period in multiple parts.
Method of calculation:	Comparison of medium value in carbon stock in forest category used in baseline scenario, according *Estimativa do Estoque de Carbono Florestal do projeto REDD+ Manoa*
Comments	Mandatory required of Methodology VM0015 for areas with woof extraction.

Unit of data/Parameter:	**DBH**
Unit of data:	cm
Description:	Diameter to chest height (130 cm) for each tree with DBH equal or superior 15cm in each part of the forest inventory
Source:	Calculation starting from the circumference at chest height measured in field by Hdom
Description of measurement means and procedures to be applied.	DBH calculated starting from the circumference data at chest height (CAP) of each monitored tree measured in field.
Frequency of monitory/registry:	Data of forest inventory collected in up to 10 years period in multiple parts.
Value applied:	N/D

Equipment for monitoring:	Calculation starting from the circumference at chest height measured in field by using tape measure.
GQ/CQ procedures to be applied:	Mandatory monitoring, according to Methodology VM0015. Data of forest inventory collected in up to 10 years period in multiple parts.
Method of calculation:	DBH calculated starting from the circumference data at chest height (CAP) of each monitored tree measured in field.
Comments	N/D

Unit of data/Parameter:	**Deforestation planned for forest management infrastructure**
Unit of data:	Hectare (ha)
Description:	Map of areas with forest coverage converted in areas of non coverage area due to construction of roads, trails and forest yards required in forest management
Source:	Images of remote sensing, technical maps and specific field letters to monitor construction of roads, trails and forest yards in forest management
Description of measurement means and procedures to be applied.	Monitoring in areas with forest coverage will be performed through analysis of satellite images, maps to build roads, trails and yards for forest management and field verification. If planned deforestation occurs, the Forest Cover Benchmark will be update through the maps algebra. Decrease in carbon stock in project area will be reported during the processes of verification.
Frequency of monitory/registry:	During the management year of each APU.
Value applied:	N/D
Equipment for monitoring:	Field records and geographic information system.
GQ/CQ procedures to be applied:	The mapping of planned deforestation areas for the implementation of Forest Management infrastructures will be carried out through high resolution images and field verification.
Method of calculation:	If planned deforestation areas are identified, the Forest Cover Benchmark will be update through the maps algebra.
Comments	N/D

Unit of data/Parameter:	**ΔCabBSLLKt**
Unit of data:	tCO2-e
Description:	Changes in total carbon stock in belt of leakage area
Source:	Calculated
Description of measurement means and procedures to be applied.	Activities to prevent leakage will be listed; A map showing areas and type of intervention will be prepared; Areas in which activities to prevent leakages impact on carbon stock will be identified; Non forest categories within these areas in case baseline are identified; Carbon stock are measured in categories identified or conservative literature estimates are used; Changes in carbon stock in leakage management area in project scenario will be reported in Table 30b of methodology VM0015; Changes in carbon stock in liquid stage caused by prevention measures during the fixed period of baseline and, optionally, in the period of accreditation of project will be calculated; The results of calculation will be reported in Table 30.c of VM0015.
Frequency of monitory/registry:	To be determined depending of activity
Value applied:	n/a
Equipment for monitoring:	To be determined depending of activity
GQ/CQ procedures to be applied:	To be determined depending of activity
Method of calculation:	To be determined depending of activity
Comments	N/D

Unit of data/Parameter:	**Assessment of damage to forest management activity**
Unit of data:	M³/ha
Description:	Evaluation performed by sampling in the UPAs during and after the harvest operation.
Source:	Post-Exploratory Report.
Description of measurement means	See Sustainable Forest Management Plan.

and procedures to be applied.	
Frequency of monitory/registry:	Annual, after the end of the harvesting operations of each UPA.
Value applied:	Not applicable.
Equipment for monitoring:	See Sustainable Forest Management Plan.
GQ/CQ procedures to be applied:	For information on quality control and assurance procedures see section 8, item 8.1.
Method of calculation:	See Sustainable Forest Management Plan.
Comments	Evaluation performed by sampling in the UPAs during and after the harvest operation.

Unit of data/Parameter:	**Frequency of surveillance and patrol operations**
Unit of data:	Number of operations per year
Description:	Record the number of surveillance operations carried out at the farm during the monitoring period.
Source:	Patrimonial Surveillance Reports
Description of measurement means and procedures to be applied.	To be established.
Frequency of monitory/registry:	Monthly.
Value applied:	Not applicable.
Equipment for monitoring:	Not applicable.
GQ/CQ procedures to be applied:	To be established.
Method of calculation:	Not applicable.
Comments	The Patrimonial Surveillance Reports will be implemented from the validation of the project.

Community and Other Stakeholders

Unit of data/Parameter:	**Number of courses and training courses**
Unit of data:	Number/year
Description:	Number of courses and training courses performed in CEFLOM
Source:	Monitoring and activities report in the project
Description of measurement means and procedures to be applied.	Questionnaires and attendance list applied to participants.
Frequency of monitory/registry:	Annual
Value applied:	n/a
Equipment for monitoring:	n/a
GQ/CQ procedures to be applied:	Validation of information in the system in the Monitoring and activities report draft with proponents before the official publication of the report.
Method of calculation:	n/a
Comments	N/D

Unit of data/Parameter:	**Number of persons trained**
Unit of data:	Number/year
Description:	Number of people who received training in a year
Source:	Monitoring and activities report in the project
Description of measurement means and procedures to be applied.	Interviews structured and supporting document (list of presence)
Frequency of monitory/registry:	Annual
Value applied:	n/a
Equipment for monitoring:	n/a
GQ/CQ procedures to be applied:	Validation of information in the system in the Monitoring and activities report draft with proponents before the official publication of the report.
Method of calculation:	n/a
Comments	N/D

Unit of data/Parameter:	**Frequency of publication of Activity Reports**
Unit of data:	Number of reports per verification event
Description:	Time interval between publications and evaluations of activity reports.
Source:	Monitoring report and project activities.
Description of measurement means and procedures to be applied.	Interviews and structured questionnaires
Frequency of monitory/registry:	Annual
Value applied:	n/a
Equipment for monitoring:	n/a
GQ/CQ procedures to be applied:	Evaluation of the data compiled and systematized in a meeting with stakeholders to support the planning of future activities.
Method of calculation:	n/a
Comments	N/D

Unit of data/Parameter:	**Number of rural producers benefiting from the REDD+**
Unit of data:	Number of farmers
Description	Number of producers participating in the REDD+ project activities that are receiving technical follow-up after the training phase.
Source:	Reports of technical activities and interviews.
Description of measurement means and procedures to be applied:	Reports generated by the designated technical officer to advise the associations participating in the social activities of the project.
Frequency of monitory/registry:	Annual
Value applied:	n/a
Equipment for monitoring:	research format
GQ/CQ procedures to be applied:	Validation of the systematized information in the draft Monitoring Report of the project with the proponents before the official publication of the report.
Method of calculation:	n/a
Comments	N/D

Unit of data/Parameter:	**Number of benefited Associations**
Unit of data:	Number of associations
Description	Number of associations benefited by the technical monitoring of the project.
Source:	Technical Activity Reports
Description of measurement means and procedures to be applied:	Reports generated by the designated technical officer to advise the associations participating in the social activities of the project.
Frequency of monitory/registry:	Annual
Value applied:	n/a
Equipment for monitoring:	research format
GQ/CQ procedures to be applied:	Validation of the systematized information in the draft Monitoring Report of the project with the proponents before the official publication of the report.
Method of calculation:	n/a
Comments	N/D

Unit of data/Parameter:	**Gross revenue from new activities implemented after courses and training**
Unit of data:	R$/ha
Description	Additional gross revenue generated for participants in project activities after implementation of new techniques learned.
Source:	Monitoring and project activity reports
Description of measurement means and procedures to be applied:	Structured Interviews
Frequency of monitory/registry:	Annual
Value applied:	n/a
Equipment for monitoring:	n/a
GQ/CQ procedures to be applied:	Validation of the systematized information in the draft Monitoring Report of the project with the proponents before the official publication of the report.
Method of calculation:	n/a
Comments	N/D

Biodiversity

Unit of data/Parameter:	**Number of species of monitored animals**
Unit of data:	Number
Description:	Quantity of species of monitored animals
Source:	Field records, data sheets and Report to monitor fauna
Description of measurement means and procedures to be applied.	To be defined
Frequency of monitory/registry:	twice a year
Value applied:	N/a
Equipment for monitoring:	n/a
GQ/CQ procedures to be applied:	To be defined
Method of calculation:	Data sheets
Comments	N/D
Unit of data/Parameter:	**Diversity in vegetation communities in permanent parts**
Unit of data:	n/a
Description:	Variety of species found in vegetation within permanent parts.
Source:	Field records, data sheets and post exploratory report
Description of measurement means and procedures to be applied.	To be defined
Frequency of monitory/registry:	One year before harvesting. In intervals of one, tree and five years after harvesting in APU.
Value applied:	To be defined
Equipment for monitoring:	To be defined
GQ/CQ procedures to be applied:	To be defined
Method of calculation:	Data sheets
Comments	N/D

Unit of data/Parameter:	**Monitoring of *Ateles chameck*** *(*Spider monkey**)**
Unit of data:	Abundance
Description:	Monitoring of ***Ateles chameck*** *specie (*Spider monkey)
Source:	Survey in the field
Description of measurement means and procedures to be applied.	Data survey must be performed periodically by a specialist team
Frequency of monitory/registry:	twice a year
Value applied:	n/a
Equipment for monitoring:	To be defined
GQ/CQ procedures to be applied:	To be defined
Method of calculation:	Linear transection
Comments	N/D

Unit of data/Parameter:	**HCVF Saleiro**
Unit of data:	Number of species present
Description:	
Source:	Survey in the field
Description of measurement means and procedures to be applied.	Data survey must be performed periodically by a specialist team
Frequency of monitory/registry:	twice a year
Value applied:	n/a
Equipment for monitoring:	Cameras trap
GQ/CQ procedures to be applied:	To be defined
Method of calculation:	To be defined
Comments	N/D

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