THE ENVIRA AMAZONIA PROJECT

A Tropical Forest Conservation Project in Acre, Brazil

Document Prepared By
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1 PROJECT DETAILS

1.1 Summary Description of the Project

The Envira Amazonia Project seeks to help protect and conserve tropical forest by providing payments for ecosystem services. This type of project is known as a Reducing Emissions from Deforestation and forest Degradation project (REDD project). This project is being developed and registered under the Verified Carbon Standard (VCS) and the Climate, Community and Biodiversity Standard (CCBS). Project development involved engaging a large landowner willing to forgo conversion of forest land to a ranching operation, working with the local communities surrounding the project area, engaging Acre state officials working on reducing deforestation pressures on the regional/state level, and putting into operation the REDD project implementation plan with the help of local partners.

The Envira Amazonia REDD APD Project will generate GHG emission reductions by foregoing forest conversion to grassland in favor of conservation of the tropical forest (i.e., maintaining existing carbon stocks). The project will also mitigate deforestation pressures in the wider region using a combination of environmental programs and social programs intended to improve the livelihoods of community members living in the vicinity of the project area. Social projects and programs for the local communities will not only generate sustainable economic opportunities, but will also result in a reduction in deforestation in the region and the preservation of biodiversity.

The Envira Amazonia Project is located near Feijó in Acre, Brazil. The property where the project area is located covers an area of 200,000 hectares. Feijó, the closest town to the Envira Amazonia Project, is located between the towns of Sena Madureira and Cruzeiro do Sul along Highway BR-364. The recent paving of Highway BR-364, the main east-west highway in Acre, in 2011 has greatly increased market access in the region and increased property values as cattle ranching along this road corridor has expanded. The project property is connected to BR-364 by a secondary road and is accessible by 4-wheelers paths found throughout the property.

A signed Tri-Party Agreement between JR Agropecuária e Empreendimentos LTDA, Carbon Securities and CarbonCo, LLC lays out the roles and responsibilities for each project proponent, and documents the transfer of some portion of the carbon rights from JR Agropecuária e Empreendimentos to Carbon Securities and CarbonCo. At the time of signing the initial Tri-Party Agreement (August 2, 2012), there were three investors in JR Agropecuária e Empreendimentos LTDA.

The principal investor Duarte Jose do Couto Neto ("Duarte") acquired extensive land holdings in the early 1980s and managed the lands for rubber extraction. At the height of Duarte's rubber extraction business, Duarte had acquired 840,000 hectares which was used primarily for rubber tapping and employed almost 1,500 workers. After seeing a boom in the 1980s, the rubber industry declined steadily in the 1990s leading Duarte to sell some of his lands and seek business partnerships to expand revenues.

Duarte's partnership with Bento Ferraz Pacheco ("Bento") started in 2005 on all of Duarte's remaining land holdings, which at that time totaled approximately 450,000 hectares. With Bento's experience in cattle ranching, the intention of this partnership was to expand cattle ranching and agriculture on the properties. At the height of Bento's business, he owned several ranches in Mato Grosso, over 200,000 head of cattle, and a slaughterhouse in Bolivia.

In 2009, Bento and Duarte both sold a percentage of their business to Rubens Vasques (“Rubens”), a forest management expert.

The company JR Agropecuaria e Empreendimentos LTDA (which translates into JR Agriculture-Livestock and Ventures LTDA) was established by Duarte on July 13, 2009. Their plan was to log 20% of the property prior to converting the land to pasture. As such Milva Vasquez M.E., a logging company owned by Rubens, was to harvest all commercially valuable wood and then clear-cut to help establish a large ranch. Bento would then lead the conversion of the cleared land to pasture, including the planting of grass and installing fencing.

JR Agropecuaria e Empreendimentos LTDA first decided to pursue a planned REDD project on their land in early 2012, after Duarte learned about REDD projects in early 2012 from Almir Santana Ribeiro, a real estate agent based in Rio Branco who had previously worked with Carbon Securities.

This planned REDD project is expected to generate an average of 1,281,822 tCO_2e per year over the first baseline period over the 39,300.6 ha project area.

1.2 Sectoral Scope and Project Type

Project Scope 14: Agriculture, Forest and other Land Use (AFOLU)

Project Category: Reduction Emission from Deforestation and Degradation (REDD)

Type of Activity: Avoided Planned Deforestation (APD)

Grouped Project: No

This project is being registered under the Verified Carbon Standard (VCS) as a Reducing Emissions from Deforestation and Degradation (REDD) project and has been developed in compliance with the Verified Carbon Standard[1], Version 3.5 and VCS AFOLU Requirements[2]. The project will reduce emissions from planned deforestation.

[1] VCS. 2015 VCS Standard. Version 3.5, 25 March 2015. Verified Carbon Standard, Washington, D.C.
[2] VCS. 2013 Agriculture, Forestry and Other Land Use (AFOLU) Requirements. Version 3.4, 08 October 2013. Verified Carbon Standard, Washington, D.C.

1.3 Project Proponent

The three main project proponents are CarbonCo, LLC ("CarbonCo"), Freitas International Group, LLC ("Carbon Securities"), and JR Agropecuária e Empreendimentos EIRELI. CarbonCo, the wholly-owned subsidiary of Carbonfund.org, is responsible for getting the project certified and for project finance. Carbon Securities acts as a liaison between CarbonCo and JR Agropecuária e Empreendimentos, acts as a translator, and assists with logistics for site visits. JR Agropecuária e Empreendimentos is an Acre, Brazil-based organization created by the landowner and is primarily responsible for day-to-day management of the Project.

Organization name	CarbonCo, LLC
Contact person	Brian McFarland
Title	Director
Address	3 Bethesda Metro Center, Suite 700, Bethesda, Maryland, 20814, USA
Telephone	001-240-247-0630
Email	BMcFarland@CarbonCoLLC.com

Organization name	JR Agropecuária e Empreendimentos EIRELI
Contact person	Duarte Jose do Couto Neto or Rege Ever C. Vasques
Title	Duarte Jose do Couto Neto is Owner of Company
Address	Travessa Alagoas, Number 49, Altos, Bairro Centro Rio Branco, Acre, Brazil, CEP (Zip Code) 69900-412
Telephone	Duarte: 55 (68) 9232-7475 Rege: 55 (68) 9201-1060
Email	Duarte: GracaPCouto@gmail.com Rege: RegeEver@hotmail.com

Organization name	Freitas International Group, Doing Business as Carbon Securities
Contact person	Pedro Freitas
Title	Founder and President
Address	201 S. Biscayne Boulevard, 28th Floor, Miami, Florida, 33131, USA
Telephone	001-305-209-0909
Email	PedroFreitas@CarbonSecurities.org

1.4 Other Entities Involved in the Project

Organization name	TerraCarbon LLC
Role in the project	Independent consultant to co-lead project development kick-off; design and manage forest carbon inventory; lead baseline development task; develop project document and advise CarbonCo on all aspects of project development.
Contact person	James Eaton and David Shoch
Title	James Eaton, Senior Manager, Forestry and Technical Services David Shoch, Director, Forestry and Technical Services
Address	5901 N. Sheridan Road, Peoria, Illinois 61614, USA
Telephone	001-434-326-1144
Email	James.Eaton@TerraCarbon.com and David.Shoch@TerraCarbon.com

Organization name	TECMAN
Role in the project	Independent consultant to lead and supervise collection of field data during the course of the forest carbon inventory.
Contact person	Igor Agapejev de Andrade and Fabio Thaines
Title	Igor and Fabio are co-owners of TECMAN
Address	Rua Copacabana, nº 148, Sala 204, Conjunto Village Maciel, CEP 69.914-380 Rio Branco, Acre, Brasil
Telephone	55-68-3227-5273
Email	FabioThaines@tecman.eng.br and IgorAgapejev@tecman.eng.br

Organization name	Antonio Willian Flores de Melo of Universidade Federal do Acre Centro de Ciências Biológicas e da Natureza
Role in the project	Independent consultant to assist with review of the project baseline.
Contact person	Antonio Willian Flores de Melo
Title	Independent Consultant
Address	Universidade Federal do Acre Centro de Ciências Biológicas e da Natureza, Distrito Industrial, CEP 69.915-900, Rio Branco, Acre, Brasil
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1.5 Project Start Date

The Envira Amazonia Project has a project start date of August 2, 2012. On this day the Tri-Party Agreement between the project proponents was signed and JR Agropecuária e Empreendimentos EIRELI agreed to pursue a forest conservation project rather than clear the land for lumber and establishment of a ranch.

1.6 Project Crediting Period

The Envira Amazonia Project has an initial project crediting period of 30 years, starting on August 2, 2012. The initial baseline period started on August 2, 2012 and is set to continue through August 1, 2022. The initial project crediting period is set to end on August 1, 2042.

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

The Envira Amazonia Project is considered to be a “Large Project”, as the estimated annual emission reductions for the first baseline period is 1,259,646 tCO_2e per year, greater than the 300,000 tons of CO_2 per year which indicates a “Large Project”.

Project	N/A
Large Project	X

Years	Estimated GHG emission reductions (tCO2e)
2013	1,926,524
2014	2,022,336
2015	2,144,420
2016	2,315,864
2017	2,430,403
2018	351,383
2019	351,383
2020	351,383
2021	351,383
2022	351,383
Total estimated ERs	12,596,462
Total number of crediting years	10
Average annual ERs	1,259,646

1.8 Description of the Project Activity

The main objective of the Envira Amazonia REDD APD Project is the conservation of the tropical forest in the project region. The primary project activity, undertaken by JR Agropecuária e Empreendimentos EIRELI, is voluntarily foregoing the clearing of the project area and conversion of the land to a large-scale cattle ranch.

The Envira Amazonia Project will further mitigate deforestation in the region by mitigating deforestation pressures using a combination of environmental programs and social programs which are intended to improve the livelihoods of community members living in the vicinity of the project area. Social projects and programs for the local communities, will not only generate sustainable economic opportunities, but will also result in a reduction in deforestation in the region and the preservation of biodiversity.

Over the Project Lifetime, JR Agropecuária e Empreendimentos EIRELI will implement the following project activities:

- Forego Clearing of the Project Area and Conversion to Pasture;
- Raise Project Awareness;
- Hire Project Manager;
- Patrol and Monitor Deforestation;
- Provide Agricultural Extension Services; and
- Establish a Project Headquarters.

Project Awareness

The communities near the project area are an essential component of the Envira Amazonia Project and throughout 2014, the Envira Amazonia Project was discussed in greater detail with the local families to ensure they were fully aware of the Project, were able to contribute to the Project design, able to openly express desired outcomes and concerns, understood the third-party grievance procedure, and were able to voluntarily give Free, Prior and Informed Consent (FPIC).

Ayri Saraiva Rando was hired as an independent community specialist and visited a total of 41 families between May 20th and June 11th, 2014.

Local families who wanted to join the Envira Amazonia Project either verbally agreed to join the Project and/or signed an “ata” between May 20th and June 11th, 2014. As of June 2014, all of the community members interviewed within the Envira Amazonia Project area have either signed the “ata” or verbally agreed to assist the project in reducing deforestation.

Through meeting with the local families, the Project Proponents have been able to gain the community’s insights about project design and to better incorporate the communities into the Project.

Hire Project Manager

Jose Aurimar Tavares Carneiro (Jose’s nickname is “Mazinho”) will be the local project manager of the Envira Amazonia Project. Mazinho will help with monitoring for deforestation, along with helping visitors at the Project by providing logistics. Mazinho was born on the property and has good rapport with the local families. Mazinho currently splits his time between staying at his house in Feijó and staying at his house along the Envira River.

In addition to Mazinho's assistance, Francisco Circlandio ("Francisco") will also assist with the project as Francisco lives along with Jurupari River. Francisco is the son of Cazuza Circlandio; Cazuza lives in Feijó and Cazuza's house along the Jurupari River is temporarily serving as the Envira Amazonia Project's informal headquarters.

Patrol and Monitor Deforestation

In addition to serving as local project managers, Jose Aurimar Tavares Carneiro (Mazinho) and Francisco Circlandio will both monitor for deforestation in the project area along the Jurupari, Purus and Envira Rivers by boat approximately every 60 days.

JR Agropecuária e Empreendimentos EIRELI purchased a boat with 15 seats and a boat engine in May 2014 which will be used to access the property and for deforestation monitoring. The first formal monitoring started in June 2014.

When deforestation is identified, JR Agropecuária e Empreendimentos EIRELI will document and transfer this information to Carbon Securities and CarbonCo. Collectively, CarbonCo and JR Agropecuária e Empreendimentos will discuss the appropriate actions to undertake to counteract any reported deforestation.

Forest monitors will write down observations, document community meetings, input this data into the monitoring template, and share this information among the Project Proponents. A monitoring template will be completed, including the following information:

- Name of Monitor
- Date of Monitor
- Communities Visited
- Meeting Notes with Community
- Grievances and Concerns of Community
- Location and Date of Deforestation
- Responsible Actor for Deforestation
- Observations Pertaining to Deforestation
- Biodiversity Observed
- Other Notes Related to the Project

Provide Agricultural Extension Services

Based off feedback from the local families, JR Agropecuária e Empreendimentos EIRELI will offer several agricultural extension courses. Such agricultural extension courses shall include: alternatives to the use of fire in land preparation; improved pasture management, including rotational cattle pastures and vaccinations; extraction and processing of medicinal plants for commercial purposes; production of açaí; and raising chickens.

Establish a Project Headquarters

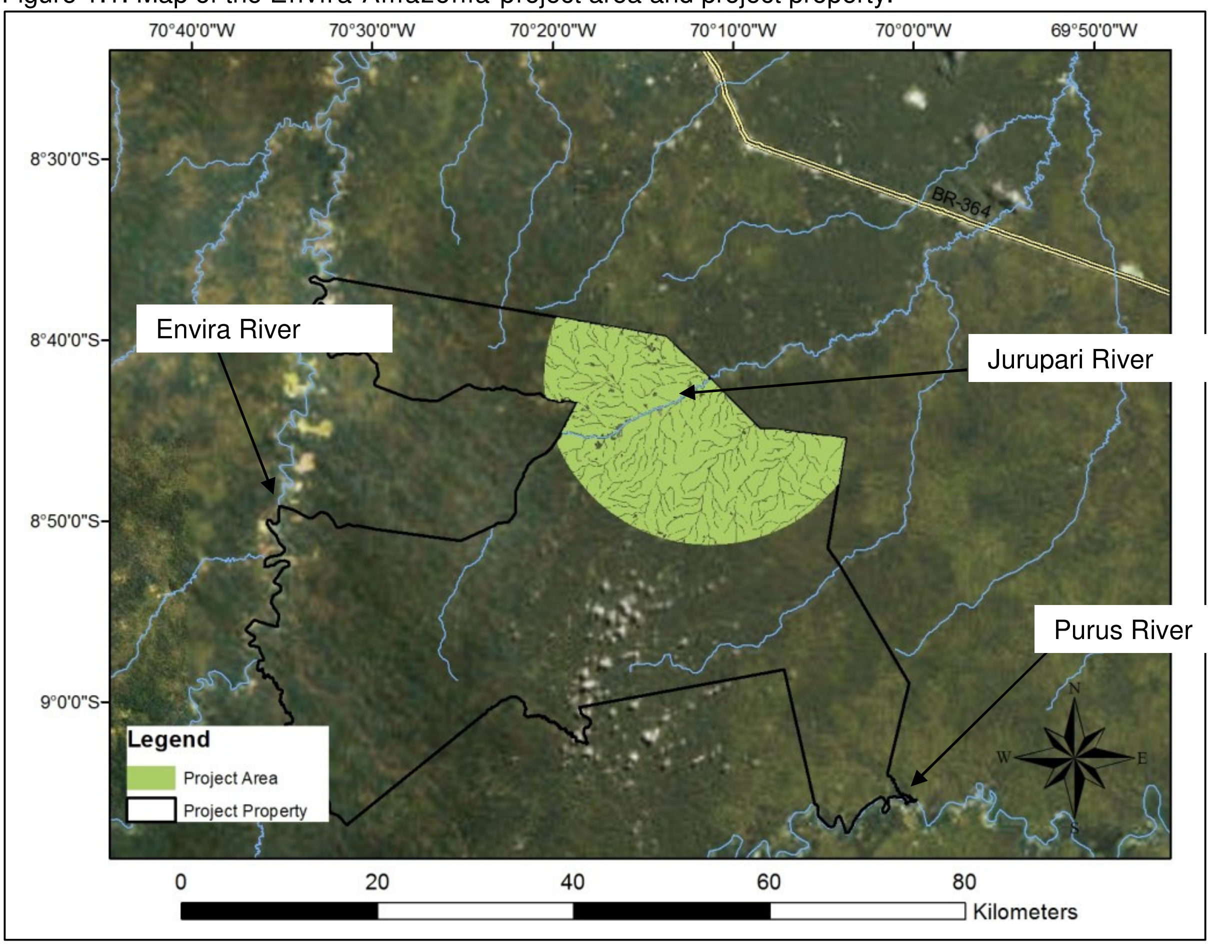
In the past, JR Agropecuária e Empreendimentos EIRELI had a headquarters established along the Envira River and the headquarters was called the "Casarao Antigo do Seringal Canada." In the future, this headquarters will be reactivated and an official headquarters will be established inside the Project Area along the Jurupari River. In the short term, Cazuza's house will be temporarily used as the informal headquarters of the Envira Amazonia Project.

The future headquarters will provide: a place for visitors to sleep and eat; a place for community meetings and teaching courses; storage for project equipment and education.

1.9 Project Location

The Envira Amazonia Project area is located in Acre, Brazil along the banks of the Jurupari River (see Figure 1.1) about 60 km southeast of the town Feijó. The total project area (i.e., forested area of the property as of the project start date, and 10 years prior) is 39,300.6 hectares. This represents less the 20% of the project property which totals 200,000 hectares. The project area is the portion of the property closest to BR-364 along the Jurupari River.

Figure 1.1. Map of the Envira Amazonia project area and project property.



1.10 Conditions Prior to Project Initiation

Background information on the project area including environmental variables in and around the project region is provided in this section. The project has not been implemented to generate GHG emissions for the purpose of their subsequent reduction, removal or destruction. This is substantiated by the landowner's commitment (and contractual obligation) to the conservation of the project area and implementation of activities which result in the preservation of forest in Acre state.

Climate

The climate in the State of Acre is fairly consistent throughout the state. The average annual temperature is 24.5 C[3] and the average annual rainfall is 1,950-2,250 mm/yr. The rainfall in the project area is around 2,100 mm/yr (see Figure 1.2). In general, the rainy season extends from November to April and the dry season from June to September.

Vegetation

The vegetation in the region of the Envira Amazonia Project area is predominantly classified as Floresta Ombrófila Aberta (as open rainforest, RADAMBRASIL[4]). While open rainforest occurs throughout most of Acre State, vegetation differences are driven by geomorphological features and soil type. These differences are manifested in part in the relative proportion of certain species of palms, bamboo, and vines.

A vegetation map produced by the State of Acre[5] was used to stratify the project area (Figure 1.3). There are four strata present in the project area including:

1. Open forest with palm and bamboo and dense forest (FAP + FAB + FD);
2. Open forest with palm and bamboo (FAP + FAB);
3. Open forest with bamboo and palm (FAB + FAP); and
4. Open alluvial forest with bamboo (FAB – Aluvial).

Soils

The project area is covered by cambisols (see Figure 1.4). This soil type is characterized as a weathered soils with weak horizon development/differentiation. These mostly brownish soils are fine to medium textured and make good agricultural land. Description of the soil orders were based on the Brazilian System of Soil Classification.

There are no organic soils (i.e., histosols) in or around the project area.

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[3] ACRE. Governo do Estado do Acre. Secretaria de Estado de Planejamento e Desenvolvimento Econômico-Sustentável, Secretaria de Estado de Meio Ambiente e Recursos Naturais. Programa Estadual de Zoneamento Ecológico-Econômico do Acre. Zoneamento Ecológico-Econômico do Acre Fase II. Documento Síntese, 2006.
[4] BEZZERA, P.E.L. Compartimentação morfotectônica do interflúvio Solomões-Negro. 2003. 335 f. Tese (Doutorado em Geologia) Universidade Federal do Pará, Belém, 2003.
Brasil. Departamento Nacional da Produção Mineral - Projeto RADAMBRASIL. Geologia, Geomorfologia, Pedologia, Vegetação e Uso Potencial da Terra. Folha V.12 FIS SC 19. Rio Branco; Rio de Janeiro, 1976.
[5] ACRE. Governo do Estado do Acre. Secretaria de Estado de Planejamento e Desenvolvimento Econômico-Sustentável, Secretaria de Estado de Meio Ambiente e Recursos Naturais. Programa Estadual de Zoneamento Ecológico-Econômico do Acre. Zoneamento Ecológico-Econômico do Acre Fase II. Documento Síntese, 2006.

Rivers

The project property is bounded by the Envira River in the west and the Purus River in the east (see Figure 1.1). A smaller river, the Jurupári River, runs through the middle of the project area (see Figure 1.5) and can be used for transport during the wetter months of the year. Many permanent and perennial streams can be found throughout the project area.

History

The Envira Amazonia Property was historically used for rubber tapping and an extractive area for natural forest products, but this sustainable use has ceased since the crash in rubber prices in the late 1980s and early 1990s.

The project areas was covered by 100% forest ten years prior to the project start in 2002 (Figure 1.6) and at the time of the project start in 2012 (Figure 1.7).

Figure 1.2. Precipitation isolines (30 year average 1961-1991) in the vicinity of the project area.

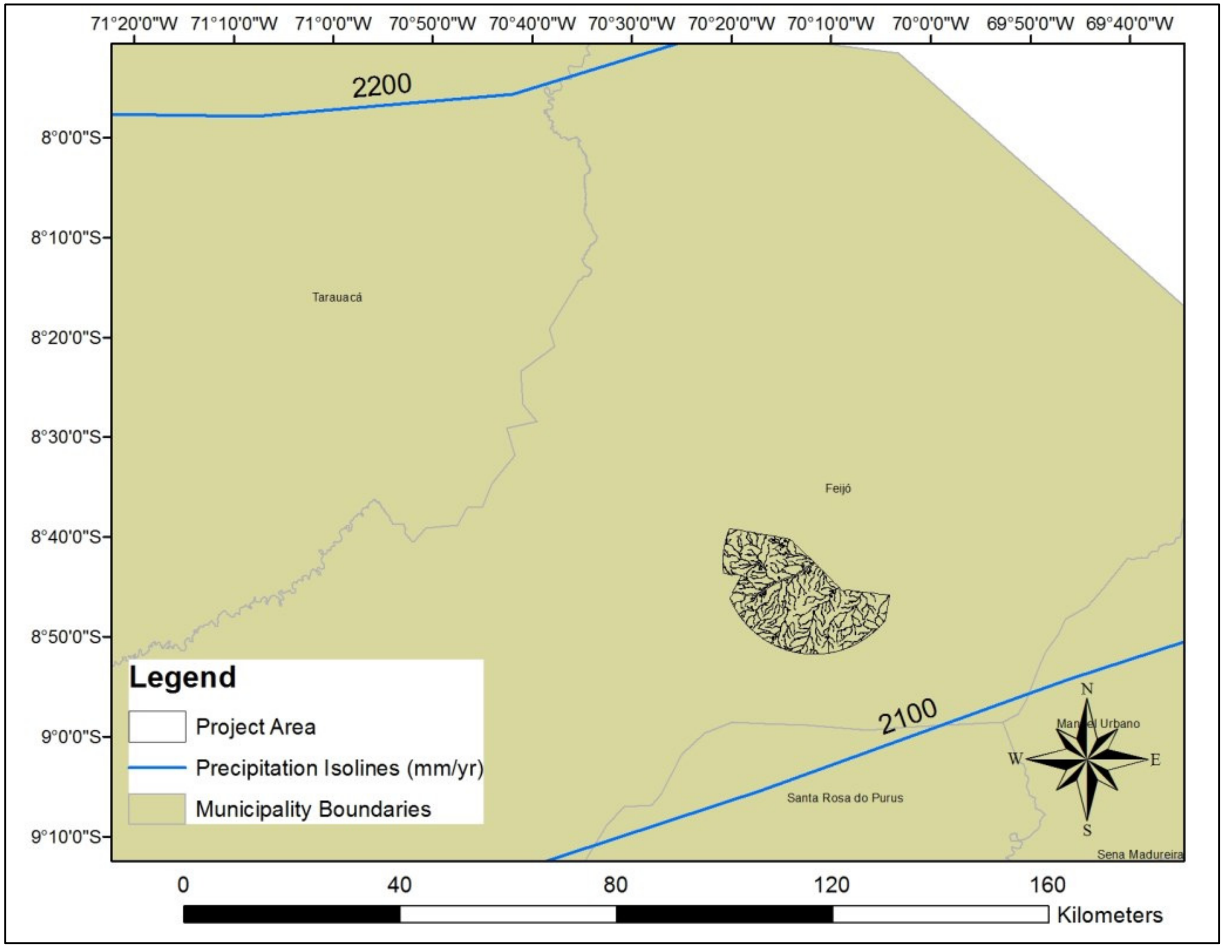


Figure 1.3. Vegetation strata in the project area.

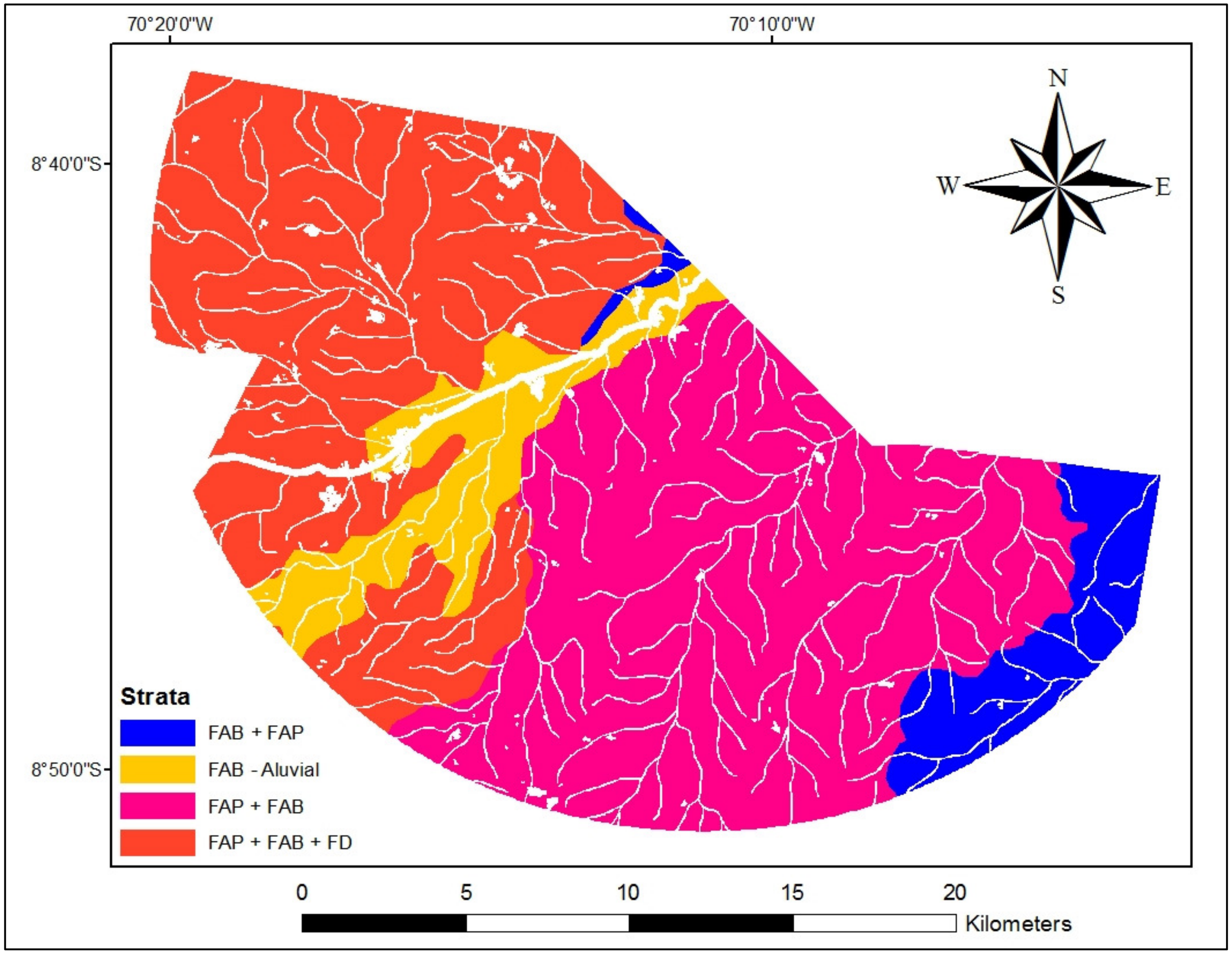


Figure 1.4. Soil type in the vicinity of the project area.

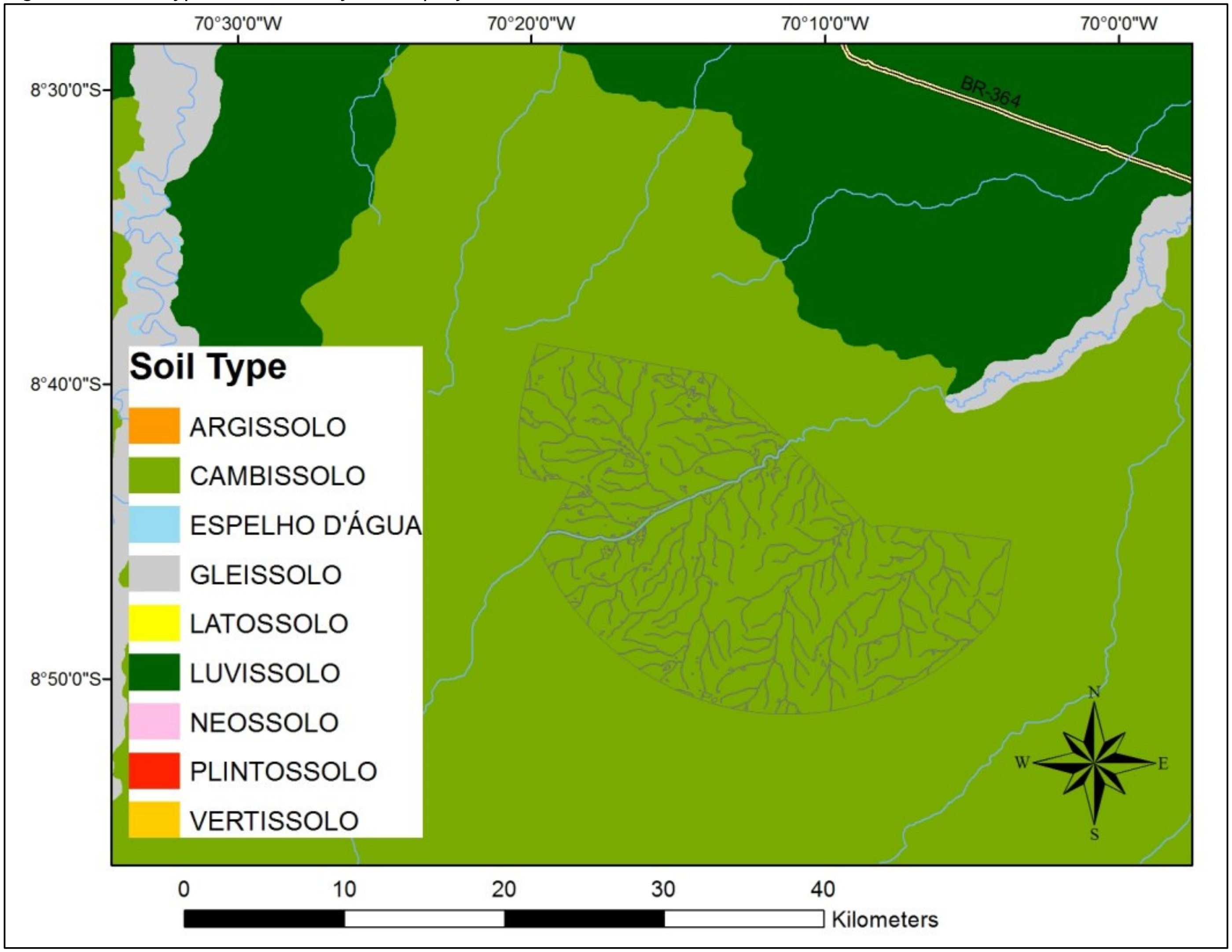


Figure 1.5. Rivers in the vicinity of the project area.

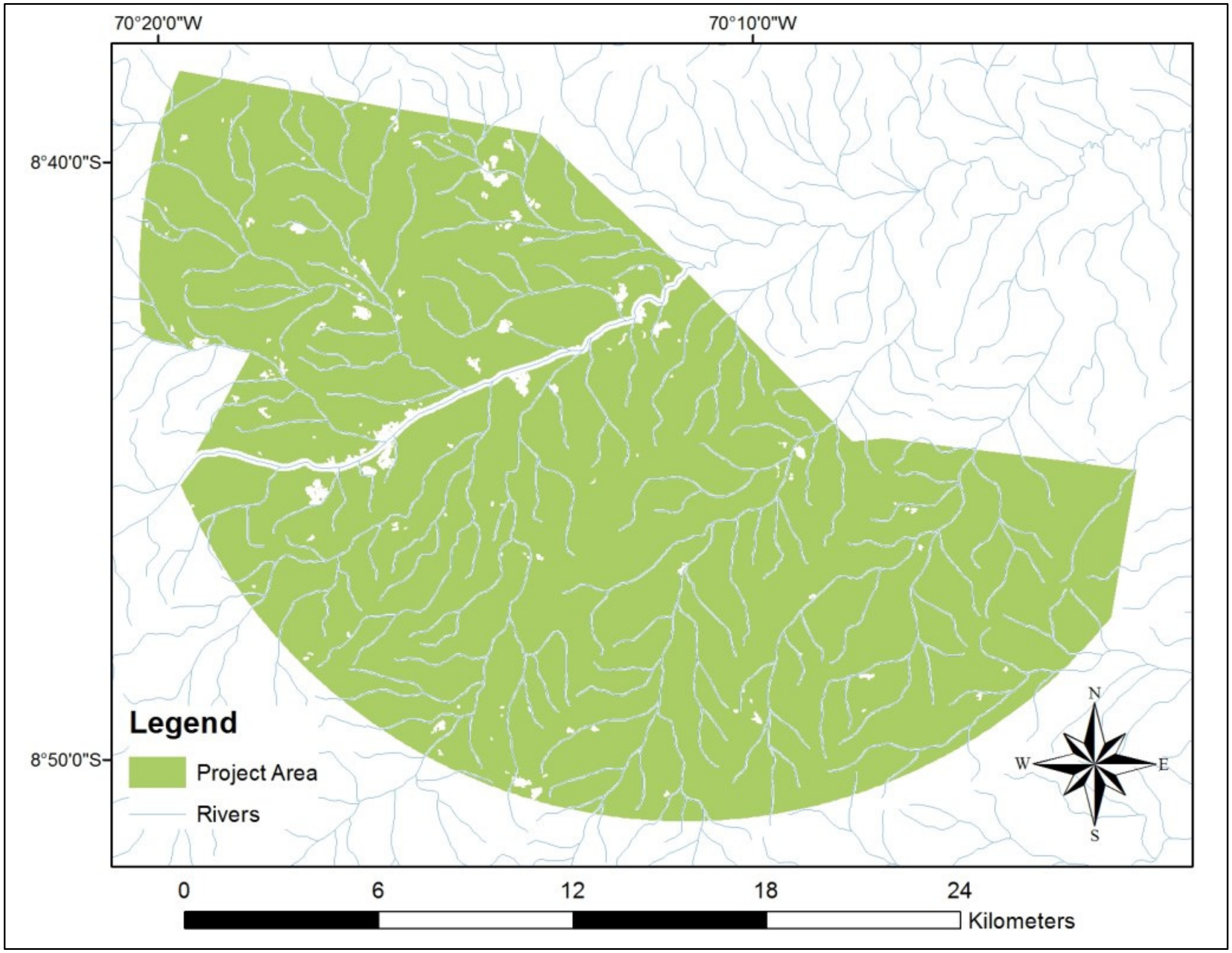


Figure 1.6. 2002 Forest Cover Benchmark Map (Green = Forest; Red = Nonforest).

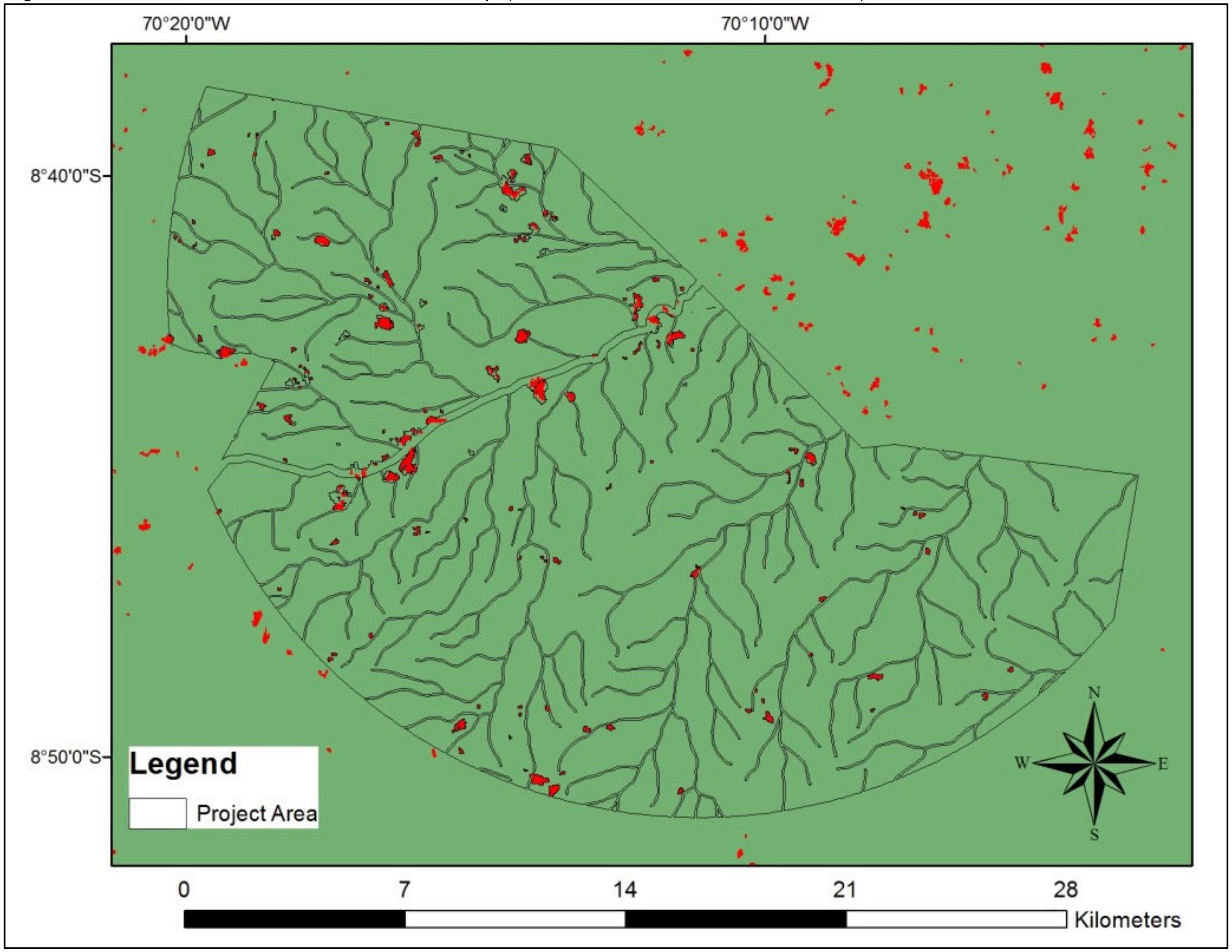
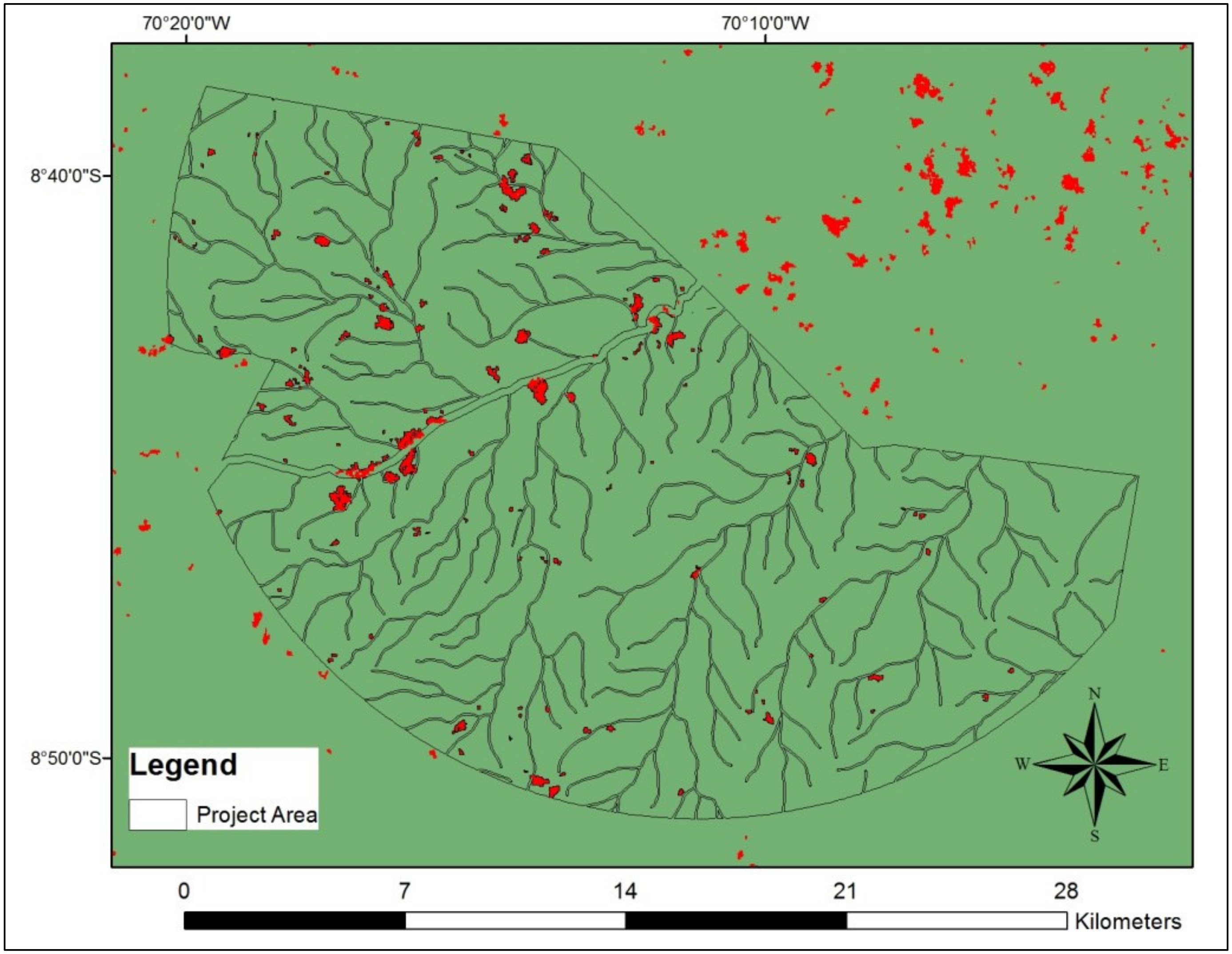


Figure 1.7. 2012 Forest Cover Benchmark Map (Green = Forest; Red = Nonforest).



1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

All Project Proponents of the Envira Amazonia Project have maintained compliance with relevant local, state, and national laws, statues and regulatory frameworks.

National Laws and Regulatory Frameworks

The Envira Amazonia Project abides by Brazilian national laws including the Brazilian Constitution. Chapter 6 of the Brazilian Constitution specifically discusses environmental issues in Article 225[6] , and the project activity aligns with the national mandate as expressed in Article 225 paragraph 4, below.

> Paragraph 4 - The Brazilian Amazonian Forest, the Atlantic Forest, the Serra do Mar, the Pantanal Mato-Grossense and the coastal zone are part of the national patrimony, and they shall be used, as provided by law, under conditions which ensure the preservation of the environment.

Further all provisions of the Brazilian Forest Code are adhered to by the Envira Amazonia Project.

These include:

- The original Brazil Forest Code entitled, Law No. 4771, September 15, 1965.[7]
- Revision of Brazil Forest Code under Law No. 7803, July 18, 1989.[8]
- Provisional Measure under No, 2166-67, August 24, 2001.[9]
- Revision of Brazil Forest Code under Law No. 12.651 of May 25, 2012.[10]

Title of Law

Law Number 4771 of September 15, 1965, entitled “Establishing the new Forest Code.”

Summary of Law

Law Number 4771 of September 15, 1965 was the original Brazil Forest Code. A few major provisions of the Forest Code were the establishment of permanent preservation areas (APP), establishment of legal reserves of 50% on properties in the Legal Amazon, and designation of Acre State (among others) as within the Legal Amazon territory.[11] Many of these provisions have been revised since 1965.

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[6] Georgetown University, “1988 Constitution, with 1996 reforms in English,” http://pdba.georgetown.edu/Constitutions/Brazil/english96.html#mozTocId920049

[7] Presidency of the Republic, “Law No. 4771, September 15, 1965,” Available: http://www.planalto.gov.br/ccivil_03/Leis/L4771.htm

[8] Presidency of the Republic, “Law No. 7803, July 18, 1989,” Available: http://www.planalto.gov.br/ccivil_03/leis/L7803.htm

[9] Presidency of the Republic, “Provisional Measure 2166-67, August 24, 2001,” Available: https://www.planalto.gov.br/ccivil_03/MPV/2166-67.htm

[10] Presidency of the Republic, Civil House Cabinet Subcommittee for Legal Affairs, “Law No. 12,651, of 25 May 2012,” Available: http://www.planalto.gov.br/ccivil_03/_Ato2011-2014/2012/Lei/L12651.htm

[11] Presidency of the Republic, “Law No. 4771, September 15, 1965,” Available: http://www.planalto.gov.br/ccivil_03/Leis/L4771.htm

Compliance with Law

The Envira Amazonia Project, as can be documented via satellite imagery or firsthand observations, has respected the Project's permanent preservation areas and legal reserves.

Title of Law

Law Number 6.938 of August 31, 1981 entitled, "Provides for the National Environmental Policy, its aims and mechanisms for the formulation and implementation, and other measures."

Summary of Law

Law Number 4771 of August 21, 1981 is based off Brazil's constitution and established Brazil's National Environmental Policy. Essentially, the "National Policy on the Environment is aimed at the preservation, improvement and restoration of environmental quality conducive to life, to ensure, in the country, conditions for the socio-economic development, the interests of national security and protecting the dignity of life human." Agencies were also established to carry out the National Environmental Policy.[12]

Compliance with Law

The Envira Amazonia Project has identified, consulted and shall continue to work with the relevant agencies responsible for environmental protection, particularly with respect to REDD projects. Furthermore, the Envira Amazonia Project will seek to conserve soil and water resources, protect rare and threatened ecosystems, and promote the recovery of degraded areas and encourage environmental education.

Title of Law

Law Number 7803 of July 18, 1989 entitled, "Change the wording of Law No. 4771 of September 15, 1965, and repealing Laws Nos. 6535 of June 15, 1978, and 7511 of 7 July 1986."

Summary of Law

Law Number 7803 was the first significant amendment to the original 1965 Forest Code. For example, the permanent preserve areas were reclassified. The Law also stipulated that "the exploitation of forests and succeeding formations, both public domain and private domain, will depend on approval from the Brazilian Institute of Environment and Renewable Natural Resources - IBAMA, and the adoption of techniques of driving, exploitation, reforestation and management compatible with the varied ecosystems that form the tree cover.[13]

Compliance with Law

The Envira Amazonia Project will abide by the new guidance on permanent preserve areas such as to not clear forests on steep slopes or within one hundred meters proximity to rivers. Any such clearing that has taken place in the past, will be reforested.

[12] Presidency of the Republic, "Law No. 6.938, August 31, 1981," Available: http://www.planalto.gov.br/ccivil_03/leis/L6938.htm
[13] Presidency of the Republic, "Law No. 7803, July 18, 1989," Available: http://www.planalto.gov.br/ccivil_03/leis/L7803.htm

Title of Law

The Provisional Measure Number 2166-67 of August 24, 2001 entitled, “Changes the arts. 1, 4, 14, 16 and 44, and adds provisions to Law No. 4771 of September 15, 1965, establishing the Forest Code and amending art. 10 of Law No. 9393 of December 19, 1996, which provides for the Property Tax Territorial Rural - ITR, and other measures.”

Summary of Law

The Provisional Measure Number 2166-67 of August 24, 2001 was one of the latest revisions to the original 1965 Forest Code and to the amendments of Law Number 7803. The most relevant change to the Envira Amazonia Project was the revision of the legal reserve requirement in the Legal Amazon (i.e., including the State of Acre) from 50% to 80% which shall be conserved, which is reflected in the eligible project area (i.e. area that can be subject to authorized deforestation in the baseline), which represents less than 20% of the property area.[14]

Compliance with Law

As mentioned previously, the Envira Amazonia Project - as can be documented via remote sensing or firsthand observations - has respected both the Project’s permanent preservation areas and the recently revised legal reserve requirement.

Title of Law

Law Number 12.651 of May 25, 2012, which is the latest Brazilian Forest Code.[15]

Summary of Law

The latest Brazilian Forest Code, “Provides for the protection of native vegetation; amends Laws Nos. 6938 of August 31, 1981, 9,393, of December 19, 1996, and 11,428 of December 22, 2006, repealing the Laws No. 4771, 15 September 1965 and 7754, of April 14, 1989, and Provisional Measure No. 2.166-67, of August 24, 2001, and other provisions.”

Other key provisions of the Brazilian Forest Code include:

“CHAPTER I: GENERAL PROVISIONS

The Article 1-A. This Act lays down general rules on the protection of vegetation, Permanent Preservation Areas and Legal Reserves, forest exploitation, the supply of forest raw materials, control the origin of forest products and the prevention and control of forest fires, and provide economic and financial instruments for the achievement of its objectives

II - reaffirming the importance of the strategic role of farming and the role of forests and other forms of native vegetation in sustainability, economic growth, improving the quality of life of the population and the country's presence in the domestic and international food and bioenergy; (Included by Law No. 12,727, 2012).

[14] Presidency of the Republic, “Provisional Measure 2166-67, August 24, 2001,” Available: https://www.planalto.gov.br/ccivil_03/MPV/2166-67.htm
[15] Presidency of the Republic, Civil House Cabinet Subcommittee for Legal Affairs, “Law No. 12,651, OF 25 MAY 2012,” Available: http://www.planalto.gov.br/ccivil_03/_Ato2011-2014/2012/Lei/L12651.htm

VI - the creation and mobilization of economic incentives to encourage the preservation and restoration of native vegetation and to promote the development of sustainable productive activities.

Article 3 For the purposes of this Act, the following definitions apply:

I - Amazon: the states of Acre, Pará, Amazonas, Roraima, Rondônia, Mato Grosso and Amapá and the regions north of latitude 13 ° S, the states of Goiás and Tocantins, and west of 44 ° W , State of Maranhão;

II - Permanent Preservation Area - APP: protected area, or not covered by native vegetation, with the environmental function of preserving water resources, landscape, geological stability, biodiversity, facilitate gene flow of fauna and flora, soil protection and ensure the well-being of human populations;

III - Legal Reserve area located within a rural property or ownership, demarcated according to art. 12, with the function of ensuring a sustainable economic use of natural resources of rural property, assist the conservation and rehabilitation of ecological processes and to promote the conservation of biodiversity, as well as shelter and protection of wildlife and native flora;

VI - alternative land use: replacement of native vegetation and succeeding formations other ground covers such as agricultural activities, industrial, power generation and transmission of energy, mining and transport, urban settlements or other forms of human occupation;

CHAPTER II: AREAS OF PERMANENT PRESERVATION

Section I: Delimitation of Areas of Permanent Preservation

III - the licensing is done by the competent environmental authority;

IV - the property is registered in the Rural Environmental Registry - CAR.

CHAPTER IV: AREA LEGAL RESERVE

Section I: Delimitation of the Legal Reserve Area

Article 12. All property must maintain rural area with native vegetation cover, as a legal reserve, without prejudice to the application of the rules on the Permanent Preservation Areas, subject to the following minimum percentages in relation to the area of the property, except as specified in art. 68 of this Act: (Amended by Law No. 12,727, 2012).

I - located in the Amazon:

a) 80% (eighty percent), in the property situated in forest area;

b) 35% (thirty five percent), in the property situated in cerrado;

c) 20% (twenty percent), in the property situated in the area of general fields;

II - located in other regions of the country: 20% (twenty percent).

CHAPTER V: THE SUPPRESSION OF VEGETATION FOR ALTERNATIVE USE OF SOIL

Article 26. The removal of native vegetation to alternative land use, both public domain and private domain, depend on the registration of the property in CAR, mentioned in art. 29, and the prior authorization of the competent state agency Sisnama."

Compliance with Law

The Envira Amazonia Project is in compliance with the latest Brazil Forest Code. Acre is still considered an Amazonian State and thus, the Project must maintain 80% of forest cover as a legal reserve. This can be demonstrated via firsthand observations and review of satellite imagery.

Community Land Tenure Laws

There are communities settled, outside the project area, but on the same Envira Property, which have illegally cleared land for subsistence agriculture, cattle-ranching and housing. According to Brazilian law, there are three applicable laws which relate to this customary and legal property rights situation:

- Brazilian Federal Constitution,[16] passed on October 5th, 1988
- Brazilian Civil Code,[17] which is the Federal Law 10406, passed on January 10th, 2002
- Brazilian Civil Procedure Code,[18] which is the Federal Law 5869, passed on January 11th, 1973

In Brazil, the law requires that the acquisition of land is made by a title (i.e., a contract) and by registration. Thus if you want to buy an area of land, you need to have a title (i.e., a contract with the landowner) and then you need to register your title at the public service of land registration (i.e., called the "Cartório de Imóveis"). As stated in Article 1245 of the Civil Code, if you only have the title (i.e., the contract) and do not register it, then by the law you are not the owner of the land. However, if you have the unregistered contract and you are in possession of the land, the law refers to you as "good-faith possessor."

It is important to note that Brazilian regulation treats small lands differently than larger ones as there is the "special usucaption" and the "regular usucaption." The law requires a smaller period of time for usucaption of rural lands on fifty hectares or less, than it requires for usucaption of rural lands above fifty hectares. The Federal Constitution establishes the "special usucaption" stating in Article 191 that, "the one that, not being owner of agricultural or urban property, possesses as itself, per five years uninterrupted, without opposition, land area in rural area, not more than fifty hectares, making it productive by his work or by his family's work, and living in there, will acquire its ownership." The Civil Code, in Article 1239, repeats what the Constitution states about usucaption of rural lands not above fifty hectares.

For the usucaption of lands above fifty hectares, or even for those who possess less than fifty hectares but do not fulfill the other requirements of the "special usucaption," the applicable usucaption is the "regular usucaption," which is applicable to every kind of land (i.e., rural or urban lands and no matter their size).

[16] Presidency of the Republic, "CONSTITUIÇÃO DA REPÚBLICA FEDERATIVA DO BRASIL DE 1988," Available: http://www.planalto.gov.br/ccivil_03/Constituicao/Constituicao.htm
[17] Presidency of the Republic, "LEI Nº 10.406, DE 10 DE JANEIRO DE 2002.," Available: http://www.planalto.gov.br/ccivil_03/Leis/2002/L10406.htm
[18] Presidency of the Republic, "LEI Nº 5.869, DE 11 DE JANEIRO DE 1973.," Available: http://www.planalto.gov.br/ccivil_03/Leis/L5869.htm

The “regular usucaption” is established by the Civil Code, Article 1238. Essentially, it requires different periods of time, depending on what the possessor does on the land. The beginning of Article 1238 states: “The one that, per fifteen years without interruption or opposition, possesses as itself a land will acquire its ownership, independently of title and good-faith; and may require to a judge to declare it by sentence, which will serve as title to register the ownership at the public service of land registration.” However, Article 1238 also states that “the period of time required in this Article will be reduced to ten years if the possessor has established his habitual house or have made the land productive.” Furthermore, Article 1242 states that “acquires the Landownership the one that, without contestation, with title and good-faith, possesses the land per ten years.”

With respect to the communities living on Envira Property, but outside the project area, nobody in the community has title or good-faith possession, because none of them bought the land from the landowner JR Agropecuária e Empreendimentos EIRELI. Thus, Article 1242 is not applicable.

The one who possesses land of not more than fifty hectares, lives there for five years, makes the land productive (e.g., by growing agriculture or raising animals) and who do not own any other land (rural or urban) has the right to be titled. The one who possesses a land, not more than fifty hectares but does not fill the requirements for the “special usucaption,” along with the one who possesses land above fifty hectares, they also have the right to be titled if the possession is at least fifteen years. In this same case, if the possessor is living on the land or makes the land productive (e.g., by growing agriculture or raising animals), the required period of possession is reduced to ten years. The right to be titled is stated in the law, but it is only possible after a judge declares this right in a sentence after a procedure. As previously mentioned, to acquire a property in Brazil you have to have both title and registration. Thus even if you have possession for twenty years, you do not have ownership of the land yet. In this case, you will still have to ask a judge to declare your right in court, so you will have the title (i.e., sentence = title, in this case). After that, you will have to take the sentence of the judge and register in the public service of land registration. Then you are the official owner of the land by usucaption.

Community members that have been living on the land and who made the land productive (e.g., by growing agriculture or raising animals) for ten years, have the right to be titled. To resolve this ongoing conflict or dispute, JR Agropecuária e Empreendimentos EIRELI will voluntarily recognize whatever area is currently deforested and under productive use by each family. All communities - whether they voluntarily join the Envira Amazonia Project or not - will be titled the land they have put under productive use. If necessary, this process will be facilitated by an independent group.

State Laws and Regulatory Frameworks

The Project Proponents of the Envira Amazonia Project abide by Acre’s state laws and regulatory frameworks. Specifically these include:

- The Acre Forestry Law (Bill Number 1.426 of December 27, 2001); and
- The State System of Incentive for Environmental Services (Bill Number 2.308 of October 22, 2010).

Title of Law

Law Number 1.426, December 27, 2001, entitled, “The Acre Forestry Law.”

Summary of Law

The Acre Forestry Law Number 1,426 of December 27, 2001 essentially, “provides for the preservation and conservation of State forests, establishing the State System of Natural Areas, creates the State Forest Fund and other measures.” The Law also established the institutional responsibility for the management of State Forests, defines forests, and outlines the administrative penalties for non-compliance.

Compliance with Law

The Envira Amazonia Project is on private property and thus, this law is not relevant. Nevertheless, the Project Proponents shall contribute to the sustainable use of forest resources and preserve biodiversity.[19]

Title of Law

Law Number 2.308 of October 22, 2010 entitled, “The State System of Incentive for Environmental Services.”

Summary of Law

The State System of Incentive for Environmental Services (SISA) was “created, with the aim of promoting the maintenance and expansion of supply of the following ecosystem products and services:

> I - sequestration, conservation and maintenance of carbon stock, increase in carbon stock and decrease in carbon flow;
>
> II - conservation of natural scenic beauty;
>
> III - socio-biodiversity conservation;
>
> IV - conservation of waters and water services;
>
> V - climate regulation;
>
> VI - increase in the value placed on culture and on traditional ecosystem knowledge;
>
> VII - soil conservation and improvement.”[20]

Compliance with Law

As a tropical forest ecosystem services project, otherwise known as REDD, the Envira Amazonia Project shall seek to conserve the forests’ carbon stock, while also conserving the natural scenic beauty, biodiversity, water and soil resources, along with working alongside the local communities.

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[19] The Governor of the State of Acre, “Acre Forestry Law, December, 27, 2001,” Available: http://webserver.mp.ac.gov.br/?dl_id=800

[20] State of Acre, “Unofficial Translation, State of Acre, Bill No. 2.308 of October 22, 2010,” Available: http://www.gcftaskforce.org/documents/Unofficial%20English%20Translation%20of%20Acre%20State%20Law%20on%20Environmental%20Services.pdf

Labor Laws

The Envira Amazonia Project shall meet, or exceed, all applicable labor laws and regulations and the Project Proponents will inform all workers about their rights.

The following is a list of Brazil's relevant labor laws and regulations:

- The Brazilian Constitution, Chapter II-Social Rights, Articles 7- 11 which addressed:
    - Minimum wage
    - Normal working hours
    - Guidance on vacation and weekly leave
    - Guidance on maternity and paternity leave
    - Recognition of collective bargaining
    - Prohibition of discrimination[21]

In addition to the Constitution, there are two additional decrees related to Brazilian labor laws.

- Consolidação das Leis do Trabalho (CLT): DECRETO-LEI N.º 5.452, DE 1º DE MAIO DE 1943 (Consolidate of Working Laws).[22] This decree gives more clarification on:
    - Hourly, daily, weekly and monthly work hours
    - Employment of minors and women
    - Establishes a minimum wage
    - Worker safety and safe working environments
    - Defines penalties for non-compliance by employers
    - Establishes a judicial work-related process for addressing all worker related issues
- Estatui normas reguladoras do trabalho rural: LEI Nº 5.889, DE 8 DE JUNHO DE 1973 (Establishes Regular Norms for Rural Workers).[23] This is a complimentary law to the aforementioned 1943 decree because prior to 1973, rural workers did not have the same rights as urban workers. In 1973, this law was established to specify the equality between urban and rural workers, along with compensation for overtime.

With respect to the taxation regulations relevant to the Envira Amazonia Project, Brazil has the following taxation regulations:

- COFINS (Contribution to Social Security Financing), Lei Complementar Federal 70/1991: This regulation relates to the social contribution to finance social security.

[21] Massachusetts Institute of Technology, "Brazilian Constitution," Available: http://web.mit.edu/12.000/www/m2006/teams/willr3/const.htm

[22] Presidency of the Republic, "DECRETO-LEI N.º 5.452, DE 1º DE MAIO DE 1943, Available: http://www.planalto.gov.br/ccivil_03/decreto-lei/Del5452.htm

[23] Presidency of the Republic. "LEI Nº 5.889, DE 8 DE JUNHO DE 1973," Available: http://www.planalto.gov.br/ccivil_03/leis/L5889.htm

- CSLL (Social Contribution on Net Corporate Profit), Lei Federal 7689/1988: This regulation is the social contribution calculated on net profit.
- FGTS (Length of Service Guarantee Fund), Lei Federal 8036/1990: This regulation is a contribution paid to a fund for each employee hired. When the employee is laid-off, they can take the money as compensation.
- ICMS (Tax on the Circulation of Merchandise and Interstate and Inter-municipal Transportation Services and Communications), Lei Complementar Federal 87/1996 and Lei Complementar Estadual 55/1997: These regulations are a state tax paid when you sell merchandise and thus, is not relevant to the Envira Amazonia Project.
- IRPJ (Corporate Income Tax), Lei Federal 9430/2996: This regulation is for tax paid on corporate income.
- ISS (Tax on Services of Any Nature), Lei Complementar Federal 116/2003: Each city has a similar law to fulfill the federal law and this regulation is a municipal tax paid on services.
- INSS (Social Security): Lei Federal 8212/1991: This regulation is for contribution paid for the Federal Retirement Fund.
- PIS (Social Integration Tax), Lei Complementar Federal 07/1970: This regulation is for contribution paid to the Social Integration Fund.
- ITR (Rural Land Tax), Lei Federal 9393/1996: This regulation is for tax paid on rural landownership.
- IPTU (Urban Building and Land Tax), Lei Federal 10257/2001: Each city has its complementary and similar law. This regulation is for a municipal tax paid on urban landownership and thus, not relevant to the Envira Amazonia Project.
- IPVA (Tax on Automotive Vehicles), Lei Federal 8441/1992: Each city has its complementary and similar law. This regulation is for a municipal tax paid on the ownership of vehicles.[24],[25]

Compliance with Law

Agreements between the Project Proponents as well as Agreements between CarbonCo and its contractors stipulate firms to abide by labor laws (for example, wages above Brazil’s federal minimum wage) and to assure all employment taxes and insurance are paid.

In addition, CarbonCo has an employee handbook to ensure proper guidelines are followed by its employees and contractors. JR Agropecuária e Empreendimentos also has an explanatory letter on labor rights that will be presented to all of their employees to ensure workers are informed about their rights.

CarbonCo undertakes an annual financial audit by an independent accountant to ensure all taxes, including employment, social and corporate, are paid. Furthermore, JR Agropecuária e Empreendimentos has provided “Certificado de Regularidade do FGTS – CRF” and the “CERTIDÃO NEGATIVA DE DÉBITOS RELATIVOS ÀS CONTRIBUIÇÕES PREVIDENCIÁRIAS E ÀS DE TERCEIROS” which certify that all taxes (including employee and business) and insurance (including social) are paid.

[24] Personal Correspondence with Mr. Leonardo Silva Cesário Rosa, Federal Prosecutor
[25] Secretariat of the Federal Revenue of Brazil, “Taxes,” Available: http://www.receita.fazenda.gov.br/principal/ingles/SistemaTributarioBR/Taxes.htm

1.12 Ownership and Other Programs

1.12.1 Right of Use

The Project Proponents have clear, uncontested title to both property rights and the carbon rights.

A copy of the property rights documentation is provided in the project database including the:

- Certidao de Inteiro Teor (or certification of full rights), and the
- Memorial Descritivo.

This documentation satisfies the VCS Standard as rights of use "arising by virtue of a statutory, property or contractual right."

Carbon Securities and CarbonCo conducted an initial search and confirmed the absence of any pending cases, lawsuits, or other problems associated with the Landowner, their CPF numbers (i.e., Cadastro de Pessoas Físicas which is equivalent to a social security number in the US), their property, or their company's CNPJ (Cadastro Nacional da Pessoa Jurídica, which is equivalent to the EIN or Employer Identification Number in the US). Absence of federal tax issues and liens associated with the Landowner and the project property were assessed and confirmed using the CPF, CNPJ and Imóvel Rural (NIRF) using the Secretariat of the Federal Reserve of Brazil website.[26]

Finally, Carbon Securities and CarbonCo visited the IBAMA, or Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis, website[27] to confirm that IBAMA has not blocked landownership titles due to noncompliance with environmental laws and regulation associated with a particular property. State and municipality level documentation[28] further demonstrated authentic landownership.

With respect to private ownership of carbon rights in Brazil, a Presidential Decree on July 7, 1999 by the Brazilian Government established the Inter-ministerial Commission on Global Climate Change as the Designated National Authority for approval of projects under the UNFCCC Kyoto Protocol's Clean Development Mechanism (CDM).[29]

José D.G. Miguez, Executive Secretary of the Brazilian Interministerial Commission on Global Climate Change, presented on March 18, 2003 at the Organization for Economic Co-operation and Development (OECD) Global Forum on Sustainable Development: Emissions Trading Concerted Action on Tradable Emissions Permits (CATEP) Country Forum. Within in presentation, Mr. Miguez specifically indicated the private sectors ability "to design, develop and implement CDM project activities" in Brazil.[30] This said,

[26] http://www.receita.fazenda.gov.br/grupo2/certidoes.htm
[27] IBAMA, "Certidão Negativa de Débito," Available: http://www.ibama.gov.br/sicafiext/sistema.php
[28] Ministry of Justice of Brazil, "Cadastro de Cartório do Brasil," Available: http://portal.mj.gov.br/CartorioInterConsulta/consulta.do?action=prepararConsulta&uf=AC
[29] Ministry of Science, Technology and Innovation, "Designated National Authority (Interministerial Commission on Global Climate Change)," Available: http://www.mct.gov.br/index.php/content/view/14666.html
[30] José D.G. Miguez, "CDM in Brazil," Available: www.oecd.org/dataoecd/9/6/2790262.pdf

there are currently numerous private sectors CDM and voluntary carbon market projects in Brazil including projects within the Agricultural, Forestry and Other Land-use (AFOLU) sector.

The Tri-Party Agreement documents the transfer of a portion of these carbon rights from JR Agropecuária e Empreendimentos EIRELI to CarbonCo and Carbon Securities.

1.12.2 Emissions Trading Programs and Other Binding Limits

No emission reductions generated by the Envira Amazonia Project are part of an emissions trading program. Further, Brazil does not currently have a national, legally binding limit on greenhouse gas (GHG) emissions nor is there currently a compliance emissions trading program which accepts REDD credits.

1.12.3 Other Forms of Environmental Credit

The Envira Amazonia Project has not nor intends to create non-VCS GHG emission reductions or any another form of environmental credit. This includes, but is not limited to, biodiversity credits, species banking, water certificates, and nutrient certificates.[31]

1.12.4 Participation under Other GHG Programs

The Envira Amazonia Project has not been registered, nor is seeking registration, under any other GHG programs. The Envira Amazonia Project is seeking registration under the Climate, Community and Biodiversity Alliance Standard.[32]

1.12.5 Projects Rejected by Other GHG Programs

The Envira Amazonia Project has neither submitted to, nor been rejected, from any other greenhouse gas program.

1.13 Additional Information Relevant to the Project

Eligibility Criteria

The Envira Amazonia Project is not a grouped project and therefore this section of the project document (PD) is not applicable.

Leakage Management

In this avoiding planned deforestation project, the baseline agent of deforestation is the same as one of the project proponents. Generally, leakage mitigation activities are directed to the baseline agents to minimize risk of displacement of activities. Risk of displacement of JR Agropecuária e Empreendimentos EIRELI planned deforestation activities is reduced through the realization of new revenues from the sale of carbon credits, which serve to replace the revenues foregone by cancelling the planned deforestation and new livestock activity.

[31] Forest Trends, "Our Initiatives," http://www.forest-trends.org/#
[32] The CCB project document is available at http://climate-standards.org/projects/

Commercially Sensitive Information

There is no commercially sensitive information in this project description document, itself. Supporting documents which include commercially sensitive information that will not be made publicly available include: the Tri-Party Agreements (along with any Addendum); Contracts with Buyers and Service Providers; and documents related to project financials used in the risk assessment, including bank statements and the pro-forma.

Further Information

Not applicable.

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

The Envira Amazonia Project is utilizing the Avoided Deforestation Partners' VCS REDD Methodology, entitled, "VM0007: REDD Methodology Modules (REDD-MF)." The only eligible activity as part of this project is avoiding planned deforestation, hence only modules related to planned deforestation are required. This project is eligible as an avoiding planned deforestation project because the forest land is expected to be converted to non-forest land in the baseline case and the land is legally permitted to be converted to non-forest. The specific modules applied to the Envira Amazonia Project are listed below.

REDD-MF, REDD Methodology Framework Version 1.5

<u>Carbon pool modules:</u>

CP-AB "VMD0001 Estimation of carbon stocks in the above- and belowground biomass in live tree and non-tree pools", version 1.1

CP-W "VMD0005 Estimation of carbon stocks in the long-term wood products pool", version 1.1

CP-D, "VMD0002 Estimation of carbon stocks in the dead-wood pool," Version 1.0

<u>Baseline module:</u>

BL-PL "VMD0006 Estimation of baseline carbon stock changes and greenhouse gas emissions from planned deforestation", version 1.2

<u>Leakage modules:</u>

LK-ASP "VMD0009 Estimation of emissions from activity shifting for avoided planned deforestation", version 1.1

LK-ME "VMD0011 Estimation of emissions from market-effects", version 1.0. Mandatory where the process of deforestation involves timber harvesting for commercial markets

<u>Monitoring module:</u>

M-MON "VMD0015 Methods for monitoring of greenhouse gas emissions and removals", version 2.1.

<u>Miscellaneous Modules:</u>

E-BB "VMD0013 Estimation of greenhouse gas emissions from biomass burning", v1.0.

X -STR "VMD0016 Methods for stratification of the project area", version 1.0.

X-UNC "VMD0017 Estimation of uncertainty for REDD project activities", version 2.0.

<u>Tools:</u>

T-SIG, CDM tool "Tool for testing significance of GHG emissions in A/R CDM project activities," Version 1.0

T-ADD, "VT0001 Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities," Version 3.0

T-BAR, “Tool for AFOLU non-permanence risk analysis and buffer determination,” Version 3.2

Use of modules, REDD-MF, M-MON, T-ADD, T-BAR, X-UNC, and X–STR, is always mandatory when using the VM0007 methodology. Further use of modules, BL-PL and LK-ASP, is mandatory in the case of projects focusing on planned deforestation. LK-ME and CP-W are mandatory where the process of deforestation involves timber harvesting for commercial markets. Use of the module T-SIG determines whether GHG emissions by sources and/or decreases in carbon pools are insignificant. Finally, CP-AB is mandatory in all cases and while CP-D is optional as the dead wood pool is greater in the project scenario than the baseline scenario.

2.2 Applicability of Methodology

The above modules are applicable because they meet the applicability conditions of the modules as set out below.

REDD-MF, REDD Methodology Framework

Table 2.1. Applicability Conditions and Justifications for the REDD Methodology Framework Module.

Applicability Condition	Justification
Land in the project area has qualified as forest at least 10 years before the project start date.	The project area complies with this condition as mentioned in Section 1.10, with complete forest cover demonstrated for the years 2002 and 2012.
The project area can include forested wetlands (such as bottomland forests, floodplain forests, mangrove forests) as long as they do not grow on peat. Peat shall be defined as organic soils with at least 65% organic matter and a minimum thickness of 50 cm^3. If the project area includes a forested wetlands growing on peat (e.g. peat swamp forests), this methodology is not applicable.	As demonstrated in Figure 1.4, no organic soils (or peatlands) exist within the project area. Further, soil carbon has been conservatively excluded as stated in section 2.3; hence the project is not subject to VCS WRC requirements.
Project proponents must be able to show control over the project area and ownership of carbon rights for the project area at the time of verification.	As demonstrated in Section 1.12, the project proponents have the control of the project area and the ownership of the carbon credits.
Baseline deforestation and baseline forest degradation in the project area fall within one or more of the following categories: Unplanned deforestation (VCS category AUDD); Planned deforestation (VCS category APD); Degradation through extraction of wood for fuel (fuelwood and charcoal production) (VCS category AUDD).	Baseline deforestation in the project area falls within the planned deforestation category, as the agents of deforestation is the project proponent.
Baselines shall be renewed every 10 years from the project start date.	The baseline will be renewed in March 2022.

All land areas registered under the CDM or under any other carbon trading scheme (both voluntary and compliance-orientated) must be transparently reported and excluded from the project area. The exclusion of land in the project area from any other carbon trading scheme shall be monitored over time and reported in the monitoring reports.	The Envira Amazonia Project is not registered in any carbon trading scheme or program, other than CCB.
If land is not being converted to an alternative use but will be allowed to naturally regrow (i.e. temporarily unstocked), this framework shall not be used.	Forest clearing in the baseline is followed by establishment of managed pasture, which prevents forest regrowth.
Leakage avoidance activities shall not include: Agricultural lands that are flooded to increase production (e.g. paddy rice); Intensifying livestock production through use of "feed-lots" and/or manure lagoons.	Leakage avoidance activities do not include flooding agricultural land or creating feed-lots or manure lagoons.

BL-PL, "VMD0006 Estimation of Baseline Carbon Stock Changes and Greenhouse Gas Emissions from Planned Deforestation and Planned Degradation"

Table 2.2. Applicability Conditions and Justifications for the VMD0006 Module.

Applicability Condition	**Justification**
The module is applicable for estimating the baseline emissions on forest lands (usually privately or government owned) that are legally authorized and documented to be converted to non-forest land.	The baseline agents of deforestation have permission to clear up to 20% of the project property. The removal of native vegetation needs final approval of the Cadastro Ambiental Rural (CAR) by SISNAMA, or the Sistema Nacional do Meio Ambiente, as stated in the 2012 Brazilian Forest Code. In the State of Acre to covert forest to pasture for domestic sales of cattle, the CAR (formerly known as the Licenciamento Ambiental Rural or LAR) process just needs to be opened. This approval is solely contingent on the below requirements being met: 1) Compliance with all Brazilian forestry laws. 2) All federal and state tax on the property must be paid in full and up to date. 3) The legal reserve area and areas of permanent protection (APPs) must be documented. This is commonly accomplished by a forest engineer or agricultural scientist signing off on a management plan which could include clear-cutting, sustainable harvesting, or a combination of these. 4) The property is delineated and the geo-referenced boundaries are approved by the Instituto Nacional de Colonização e Reforma Agrária (INCRA) and registered in the Cadastro Ambiental Rural (CAR)

	(formerly known as the Licenciamento Ambiental Rural or LAR). The Envira Amazonia Project's planned deforestation is in compliance with all Brazilian forestry laws. The geo-referenced boundaries of the 200,000 hectare parcel have been approved by INCRA on 09 April 2010 and the parcel opened up the LAR process on 15 April 2011.[33] Approval by INCRA indicates that the delineated boundaries, the legal reserve and APPs have been approved, the CCIR demonstrates all taxes are paid, and the LAR protocol number demonstrates the LAR process has been opened.
Where, pre-project, unsustainable fuelwood collection is occurring within the project boundaries modules BL-DFW and LK-DFW shall be used to determine potential leakage.	While there is limited fuelwood collection from within the project area, fuelwood collection that does occur is sustainable. Forested areas where fuelwood collection does occur remains as forest as the amount of fuel wood collected (approximately 0.02 tonnes d.m. ha-1 yr-1) is less than the growth in aboveground biomass in the same area (3.1 tonnes d.m. ha-1 yr-1; see Table 4.9 in IPCC 2006). Further, Igor Agapejev de Andrade, a local forester familiar with the property states "Communities in Acre most often gather fuelwood originating from dead wood, usually in areas cleared for agriculture (roçados). Rarely are live trees cut down for fuelwood" (pers comm). Details of this analysis can be found in the project database. While a formal management plan does not exist for forested areas in the project area, current and expected future harvest levels of fuelwood do not result in conversion of forest to a non-forest condition and can be characterized as sustainable in "that carbon stocks [are not expected to] systematically decrease over time on these lands." There are no national or regional forestry or nature conservation regulations in relation to fuel wood collection for domestic use.

[33] See the project archive for confirmation of the INCRA documentation, CCIR Registration and the LAR registration.

M-MON, "VMD0015 Methods for Monitoring of Greenhouse Gas Emissions and Removals"

Table 2.3. Applicability Conditions and Justifications for the VMD0015 Module.

Applicability Condition	Justification
Emissions from logging may be omitted if it can be demonstrated the emissions are de minimis using T-SIG.	Logging emissions have been omitted as no commercial timber harvest occurs in the with project case.
If emissions from logging are not omitted as de minimis, logging may only take place within forest management areas that possess and maintain a Forest Stewardship Council (FSC) certificate for the years when the selective logging occurs.	Not applicable
Logging operations may only conduct selective logging that maintains a land cover that meets the definition of forest within the project boundary.	Not applicable
All trees cut for timber extraction during logging operations must have a DBH greater than 30 cm.	Not applicable
During logging operations, only the bole/log of the felled tree may be removed. The top/crown of the tree must remain within the forested area.	Not applicable
The logging practices cannot include the piling and/or burning of logging slash	Not applicable
Volume of timber harvested must be measured and monitored.	Not applicable

2.3 Project Boundary

2.3.1 Sources of GHG Emissions Associated with the Baseline, Project and Leakage

GHG emission sources included in the project boundary are listed in Table 2.4. Justifications are provided when excluded from the project boundaries.

Table 2.4. GHG Emission Sources Included in the Project Boundary.

Source	Gas	Included	Justification/ Explanation
Biomass burning	CO_2	No	CO_2 emissions are already considered in carbon stock changes.
	CH_4	Yes	CH_4 and N_2O emissions are included in both the baseline and with-project case where fires occur.
	N_2O	Yes	
Fossil Fuel Combustion	CO_2	No	Emissions from fossil fuel combustion in the baseline and project case are minimal. As per methodology module E-FCC "Fossil fuel combustion in all situations is an optional emission source."

	CH_4	No	Emissions are small and negligible.
	N_2O	No	
Use of fertilizers	CO_2	No	Excluded. No increase in fertilizer use is contemplated in the project case as part of leakage mitigation or any other activity.
	CH_4	No	
	N_2O	No	Excluded. No increase in fertilizer use is contemplated in the project case as part of leakage mitigation or any other activity.

2.3.2 Carbon Stock Associated with the Baseline, Project and Leakage

This project will include the following carbon pools (see Table 2.5).

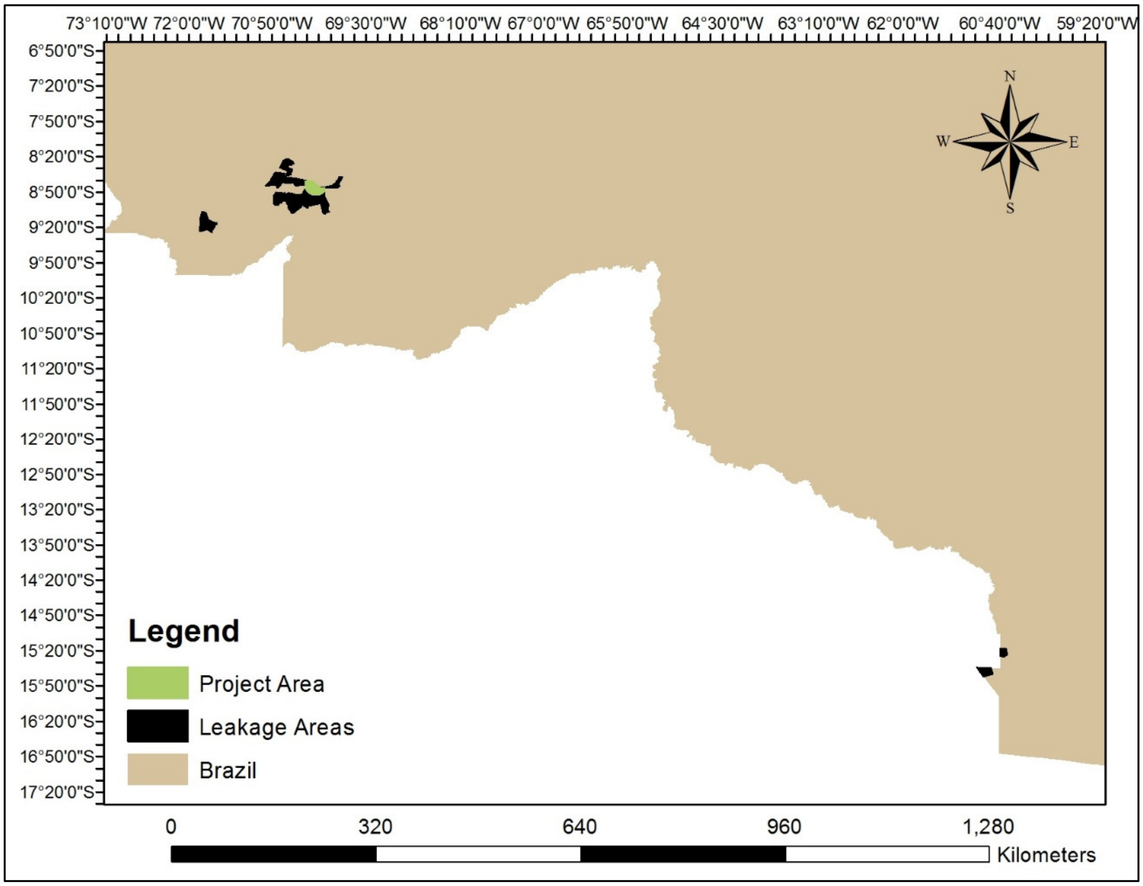
Table 2.5. Carbon Pools Included in the Project Boundary.

Carbon pools	Included / Excluded	Justification / Explanation of Choice
Aboveground	Included	Mandatory to include. Tree biomass only is included, which is the most significant pool. Non-tree woody biomass (e.g. shrubs) is less in the baseline (pasture and cropland) than the project case (forest) and is conservatively excluded.
Belowground	Included	Included and treated together with aboveground biomass for completeness to include whole tree (aboveground and belowground) biomass.
Dead Wood	Included	This pool was included as it can represent a significant component of forest biomass.
Harvested Wood Products	Included	Included as commercial harvesting for wood products takes place in the baseline as part of the forest conversion process.
Litter	Excluded	Conservatively omitted, as allowed by methodology.
Soil Organic Carbon	Excluded	Conservatively omitted, as allowed by methodology.

1. As noted in the table above, this project will consider four pools of carbon and the applicable modules include: CP-AB “VMD0001 Estimation of carbon stocks in the above- and belowground biomass in live tree and non-tree pools”, CP-D, “VMD0002 Estimation of carbon stocks in the dead-wood pool” and CP-W “VMD0005 Estimation of carbon stocks in the long-term wood products pool”.

2.3.3 Map of the project boundaries

Figure 2.1. Map of the project area and leakage areas. Leakage areas include other properties in Brazil owned or managed the by the agents of deforestation.



2.4 Baseline Scenario

The VCS "Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities" is applied to identify the baseline scenario of the project.

As the outcome of sub-step 1a of the tool, the following alternative land use scenarios were identified.

1. Continuation of pre-project land use / Project activity on the land within the project boundary performed without being registered as a VCS AFOLU project.
2. Conversion to Pasture.

As the outcome of Sub-step 1b, all land use scenarios identified above are in compliance with applicable legal and regulatory requirements. These scenarios are discussed and justified below. There is no legal requirement to undertake activities similar to the project activity. Likewise, there are no observed similar project activities in the geographical region on private lands.

2.4.1 Continuation of the Pre-Project Land Use / Project Activity on the Land within the Project Boundary Performed without being Registered as the VCS AFOLU Project

The landowner maintains the property as primary tropical rainforest.

Forest conservation in the project area, as a decision by a profit-driven landowner, would be unlikely under any non-carbon, market-related scenario. The landowner formed the partnership, JR Agropecuária e Empreendimentos EIRELI, in 2009 specifically with the goal of deforesting the non-legal reserve on the Envira Amazonia Property and converting the cleared land to pasture to establish a cattle ranch.

2.4.2 Conversion to Pasture

The most likely baseline scenario in conversion of the non-legal reserve to pasture.

JR Agropecuária e Empreendimentos LTDA is a partnership between Duarte Jose do Couto Neto, Bento Ferraz Pacheco, and Rubens Vasques. Duarte Jose do Couto Neto has extensive land holdings in Acre state and is the owner of the Envira Amazonia property. Bento Ferraz Pacheco is a rancher who owns several large ranches in Mato Grosso as well as a slaughterhouse in Bolivia. Rubens Vasques is a forest management expert. The company JR Agropecuaria e Empreendimentos LTDA (which translates into JR Agriculture-Livestock and Ventures LTDA) was established by Duarte on July 13, 2009. Their plan was to log 20% of the property prior to converting the land to pasture. As such Milva Vasquez M.E., a logging company owned by Rubens, would harvest all commercially valuable wood and then clear-cut to help establish a large ranch. Bento would then lead the conversion of the cleared land to pasture, including the planting of grass and installing fencing.

Conversion of native forest to pasture is common practice in the region. This is substantiated in the baseline, see section 3.1, whereby several landowners have deforested part of their property for pasture and establishment of ranches.

2.5 Additionality

The VCS "Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities" is applied to demonstrate additionality for the Envira Amazonia Project.

2.5.1 Simple Cost Analysis

As the project activity generates no financial or economic benefits to the project proponents other than VCS related income through the project activity, a simple cost analysis is justified.

The project activity produces no revenue, as the project area will be managed for conservation purposes, rather than for commercial timber extraction and livestock production. Costs associated with implementing project activities, project development, and VCS project validation are significant[34]. Additionally, while the project will incur ongoing costs (related to management and implementation of project activities including forest patrols and social programs), it will not generate future financial benefits other than VCU related income. The project proponents thus generate no financial benefits, and therefore the outcome of a simple cost comparison shows significant project expenditure with no financial return in the absence of

[34] Please see the "Pro Forma for Envira Amazonia Project (10-7-14).xls" for a detailed list of project costs.

VCS-related income, thus making this REDD project impractical in the absence of carbon finance, and demonstrates a clear financial barrier to project implementation.

2.5.2 Common Practice

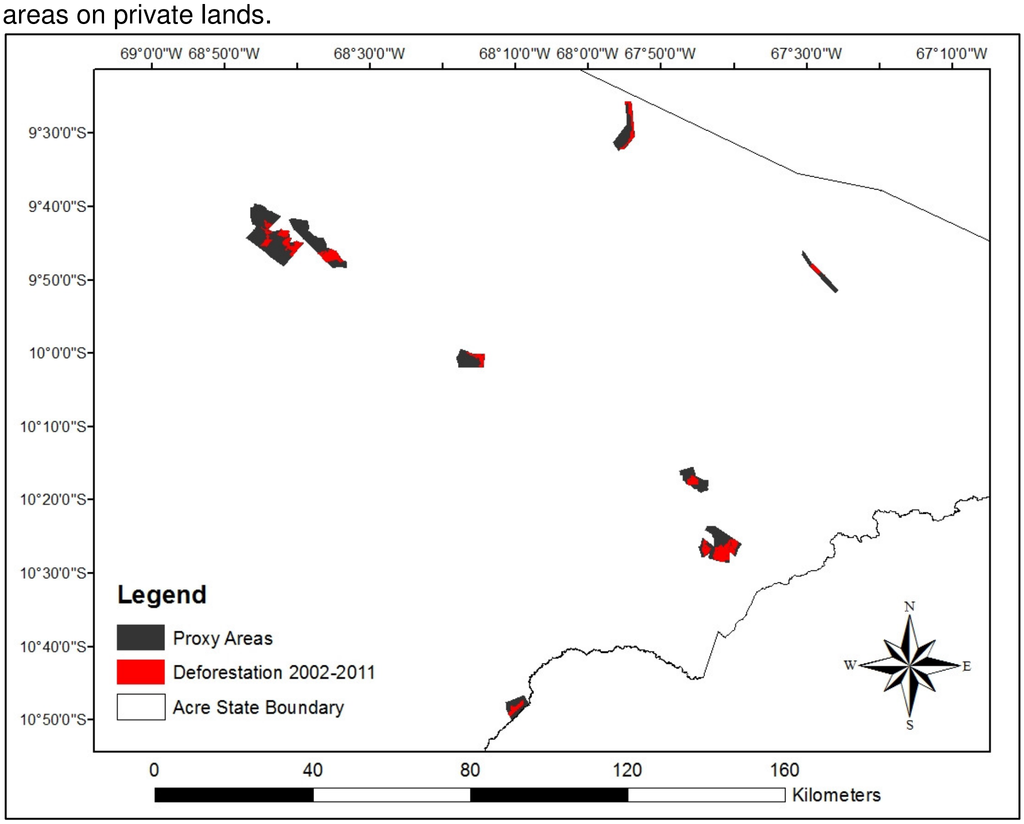
Conservation of privately owned forest land in Acre state, including the project area and proxy areas, is generally limited to the legal reserve and designated areas of permanent protection (APP). The legal reserve is a requirement of the Brazilian Forest Code for landowners in the Amazon to maintain 80% of privately owned property as forest. The landowners would be clearing the non-legal reserve on the property in the baseline.

Evidence suggests that landowners with market access (i.e., access to major roads) have deforested at least 20% of their properties, see Figure 2.2.

Conservation efforts within Acre state include a series of national, state, and local conservation areas, and indigenous reserves. However, to our knowledge, there are no privately funded projects on private lands with the aim of stopping deforestation in Acre state without the aid of carbon finance.

While the conservation areas and indigenous reserves have had some successes at maintaining forest cover, the essential distinction between these lands and the project area is that the project area is privately owned and does not have access to government resources to incentivize non-extractive land uses.

Figure 2.2. Deforestation (2002-2011) within proxy areas which substantiates the baseline. Deforestation here is restricted to large blocks of deforestation, indicative of authorized clearing in non-legal reserve areas on private lands.



2.5.3 Results of the Additionality Analysis

As demonstrated above, the project activity, without revenue from carbon credits, is unlikely to occur and is not a common practice in the region. The project is therefore additional.

2.6 Methodology Deviations

The following deviations to the methodology are applied.

1) Trees in the Cecropia genus will not be included as part of the forest inventory, due to the unavailability of applicable biomass equations. This has been proposed as a deviation as it stands in conflict with the CP-AB requirement that "all the trees above some minimum DBH in the sample plots" be measured.

2) While sampling lying dead wood using the line intersect method:

- Two 92-meter transect lines were used rather than two 50-meter transect lines;
- The sampling lines did not bisect each sample plot, but rather ran from one plot center to the next; and
- The sampling lines were oriented to the north and east, and no randomization in the bearing of the first line was employed.

3) Rather than using a root to shoot ratio to estimate belowground biomass as per the CP-AB module, belowground biomass was estimated using an allometric equation developed by Cairns et al.[35] Cairns et al. is appropriate for determining belowground biomass as this equation is published in a peer-reviewed scientific journal. In fact, guidance for new methodologies as found in VCS AFOLU Requirements version 3.4 specifically mentions the Cairns et al. equations in reference to established procedures for quantifying belowground biomass, thus indicating the appropriateness of this source.

4) The forest inventory has deviated from the criteria for selection (i.e., the equation is based on a datasets comprising at least 30 trees, with an r^2 that is ≥ 0.8) and validation of the allometric equation related to palm biomass, however the equation used is likely to result in a conservative estimate of palm biomass for the following reasons:

-Volume is calculated as the volume of a parabaloid rather than the volume of a cylinder; and

-Only stem biomass is estimated, thus conservatively excluding other aboveground biomass including palm fronds.

5) Dead wood collected for density determination was opportunistically sampled from within forest strata present in the project area. The forest inventory collected a total of 39, 42, 37 samples for the sound, intermediate, and rotten[36] classes, respectively.

6) Parameter $U_{P,SS,i,pool\#}$ will be monitored at least once every 10 years, on re-measurement of forest carbon stocks. While module X-UNC requires that monitoring of this parameter occur every $\leq$ 5 years, this

[35] Cairns, M. A., S. Brown, E. H. Helmer, and G. A. Baumgardner. 1997. Root biomass allocation in the world's upland forests. Oecologia 111, 1-11.

[36] Note that 27 of the 37 rotten samples were sourced outside the project area as those sourced from within the project area did not return to the lab intact.

requirement is inconsistent with the VM0007 pools modules, which specify that stock estimates (from which uncertainty is calculated) are assumed valid for 10 years. Therefore, a deviation to module X-UNC is applied to permit parameter $U_{P,SS,i,pool\#}$ to be monitored every $\leq$ 10 years, putting it into alignment with modules CP-AB and CP-D.

7) Rather than monitoring Cpost using modules CP-AB and CP-D as described in the MON modules, C(post) can conservatively be assumed to be zero in the with project case, not only for natural disturbance (CP,Dist,q,i , as stated in Section 5.2.3 of the M-MON module) but also for deforestation (CP,post,u,i). This deviation is conservative because subtracting zero from the baseline stocks, leads to the conclusion that ΔCpools,Def,u,i,t is equal to C(BSL,i), which leads to the maximum emission in the with project case, which is conservative. This deviation may be used for the first and each subsequent monitoring period.

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

Development of the baseline for a planned deforestation project was conducted in conformance with the VCS modular REDD methodology VM0007, specifically the BL-PL module. The agent of deforestation has been identified as one of the project proponents, JR Agropecuária e Empreendimentos EIRELI. JR Agropecuária e Empreendimentos EIRELI translates into JR Agriculture-Livestock and Ventures LTDA. JR Agropecuária e Empreendimentos EIRELI poses an immediate site-specific threat as the company was established in 2009 with the plan to clear 20% of the Envira Amazonia Property. As such Milva Vasquez M.E., a logging company owned by one of the investors in JR Agropecuária e Empreendimentos EIRELI, was to harvest all commercially valuable wood and then clear-cut the land to establish a large ranch. Bento would then lead the conversion of the cleared land to pasture, including the planting of grass and installing fencing.

3.1.1. Threat of Deforestation

The immediate site specific threat can be demonstrated by documentary proof of the following:

- Legal permissibility for deforestation;
- Suitability of project area for conversion to alternative non-forest land use;
- Government approval; and
- Evidence of similar planned deforestation activities by the baseline agent within the previous five years to show intent to deforest.

3.1.1.1 Legal Permissibility for Deforestation

Legal permission to clear 20% of the project property is established by demonstrating compliance of the baseline with Brazilian forestry laws. The following are the most relevant Brazilian laws related to forestry and land use.

With respect to Federal Law, the Brazilian Forest Code is of particular importance to the Envira Amazonia Project. Versions of the Brazilian Forest Code include the following:

- The original Brazil Forest Code entitled, Law No. 4771, September 15, 1965.[37]
- Revision of Brazil Forest Code under Law No. 7803, July 18, 1989.[38]
- Provisional Measure entitled 2166-67, August 24, 2001.[39]
- Revision of Brazil Forest Code under Law No. 12.651 of May 25, 2012[40]

[37] Presidency of the Republic, "Law No. 4771, September 15, 1965," Available: http://www.planalto.gov.br/ccivil_03/Leis/L4771.htm
[38] Presidency of the Republic, "Law No. 7803, July 18, 1989," Available: http://www.planalto.gov.br/ccivil_03/leis/L7803.htm
[39] Presidency of the Republic, "Provisional Measure 2166-67, August 24, 2001," Available: https://www.planalto.gov.br/ccivil_03/MPV/2166-67.htm
[40] Presidency of the Republic, Civil House Cabinet Subcommittee for Legal Affairs, "Law No. 12,651, OF 25 MAY 2012," Available: http://www.planalto.gov.br/ccivil_03/_Ato2011-2014/2012/Lei/L12651.htm

Title of Law

Law Number 12.651 of May 25, 2012 is the latest Brazilian Forest Code and supersedes earlier versions in 1965, 1989, and 2001.[41]

Summary of Law

The latest Brazilian Forest Code, "Provides for the protection of native vegetation; amends Laws Nos. 6938 of August 31, 1981, 9,393, of December 19, 1996, and 11,428 of December 22, 2006, repealing the Laws No. 4771, 15 September 1965 and 7754, of April 14, 1989, and Provisional Measure No. 2.166-67, of August 24, 2001, and other provisions." Key tenets of the Brazilian Forest Code include:

- Chapter 1. General Provisions
    - Article 1-A. This act lays down general rules on the protection of vegetation, Permanent Preservation Areas and Legal Reserves, forest exploitation, the supply of forest raw materials, control the origin of forest products and the prevention and control of forest fires, and provides economic and financial instruments for the achievement of its objectives.
    - II. This act reaffirms the importance of the strategic role of farming and the role of forests and other forms of native vegetation in sustainability, economic growth, improving the quality of life of the population and the country's presence in the domestic and international food and bioenergy.
    - VI. This act states the creation and mobilization of economic incentives to encourage the preservation and restoration of native vegetation and to promote the development of sustainable productive activities.
    - Article 3. For the purposes of this Act, the following definitions apply:
        - I - Amazon: the states of Acre, Pará, Amazonas, Roraima, Rondônia, Mato Grosso and Amapá and the regions north of latitude 13 ° S, the states of Goiás and Tocantins, and west of 44 ° W , State of Maranhão;
        - II - Permanent Preservation Area - APP: protected area, or not covered by native vegetation, with the environmental function of preserving water resources, landscape, geological stability, biodiversity, facilitate gene flow of fauna and flora, soil protection and ensure the well-being of human populations;
        - III - Legal Reserve area located within a rural property or ownership, demarcated according to Article 12, with the function of ensuring a sustainable economic use of natural resources of rural property, assist the conservation and rehabilitation of ecological processes and to promote the conservation of biodiversity, as well as shelter and protection of wildlife and native flora;
        - VI - alternative land use: replacement of native vegetation and succeeding formations other ground covers such as agricultural activities, industrial, power

[41] Presidency of the Republic, Civil House Cabinet Subcommittee for Legal Affairs, "Law No. 12,651, OF 25 MAY 2012," Available: http://www.planalto.gov.br/ccivil_03/_Ato2011-2014/2012/Lei/L12651.htm

generation and transmission of energy, mining and transport, urban settlements or other forms of human occupation

- Chapter 2. Area of permanent preservation
    - Section I. Delimitation of Areas of Permanent Preservation
        - Licensing is done by a competent environmental authority.
        - The property will be registered in the Rural Environmental Registry (i.e., CAR).
- Chapter 4. Legal reserve area
    - Section I. Delimitation of the Legal Reserve Area
        - Article 12. All property must maintain native vegetation cover in rural area, as a legal reserve, without prejudice to the application of the rules on the Permanent Preservation Areas, subject to the following minimum percentages in relation to the area of the property, except as specified in art. 68 of this Act: (Amended by Law No. 12,727, 2012).
            - 80% of properties located in the Amazon
            - 35% of properties located in the Cerrado
            - 20% of properties located in other regions of the country
- Chapter 5. The suppression of vegetation for alternative use of soil
    - Article 26. The removal of native vegetation for conversion to alternative land uses, both public domain and private domain, depend on the registration of the property in CAR, mentioned in Article 29, and the prior authorization of the competent state agency, SISNAMA [Sistema Nacional do Meio Ambiente].

Compliance with Law

The Envira Amazonia Project baseline is in compliance with the latest Brazil Forest Code. Acre is considered part of the Legal Amazon and thus the property maintains 80% forest cover as a legal reserve in the baseline. Licensing to practice alternative land use (e.g., cattle ranching and agriculture) would be registered in the CAR and approved by IMAC (in English: The Acre Environmental Institute) which is overseen by SISNAMA.

3.1.1.2 Suitability of Project Area for Conversion to Alternative Non-Forest Land Use

Suitability for conversion of the project area to non-forest is demonstrated in Table 3.1. This table demonstrates that the project area has similar vegetation[42] and topography to the proxy areas that have already been converted to pasture (see analysis below). As there is little climatic variation in Acre state, and both the project area and proxy areas, are within the state, the climate is also suitable for conversion to pasture. While proxy areas have different soil types, most soil types in the state are suitable for conversion to pasture, including the cambisols present in the project area.

[42] Note the "other" vegetation class is predominantly open forest that was previously cleared for pasture.

The following pictures, taken along BR-364 between Cruzeiro do Sul and Sena Madureira, are indicative of the overall suitability of the region for conversion to cattle pasture.

Figure 3.1 Photo of large ranch taken along BR-364 (taken by Ilderlei Souza Rodrigues Cordeiro and Normando Rodrigues Sales).

Figure 3.2 Photo of ranch near Feijó (taken by Ilderlei Souza Rodrigues Cordeiro and Normando Rodrigues Sales).

3.1.1.3 Government Approval

The removal of native vegetation and conversion to alternative land uses for export sales, governmental loans, or for sale of the property needs final approval of the Cadastro Ambiental Rural (CAR) by SISNAMA, or the Sistema Nacional do Meio Ambiente, as stated in the 2012 Brazilian Forest Code. In the State of Acre to covert forest to pasture for domestic sales of cattle, the CAR (formerly known as the Licenciamento Ambiental Rural or LAR) process just needs to be opened.

This approval is solely contingent on the below requirements being met:

1) Compliance with all Brazilian forestry laws.
2) All federal and state tax on the property must be paid in full and up to date.
3) The legal reserve area and areas of permanent protection (APPs) must be documented. This is commonly accomplished by a forest engineer or agricultural scientist signing off on a management plan which could include clear-cutting, sustainable harvesting, or a combination of these.
4) The property is delineated and the geo-referenced boundaries are approved by the Instituto Nacional de Colonização e Reforma Agrária (INCRA) and registered in the Cadastro Ambiental Rural (CAR) (formerly known as the Licenciamento Ambiental Rural or LAR).

The Envira Amazonia Project's planned deforestation is in compliance with all Brazilian forestry laws. The geo-referenced boundaries of the 200,000 hectare parcel have been approved by INCRA on 09 April

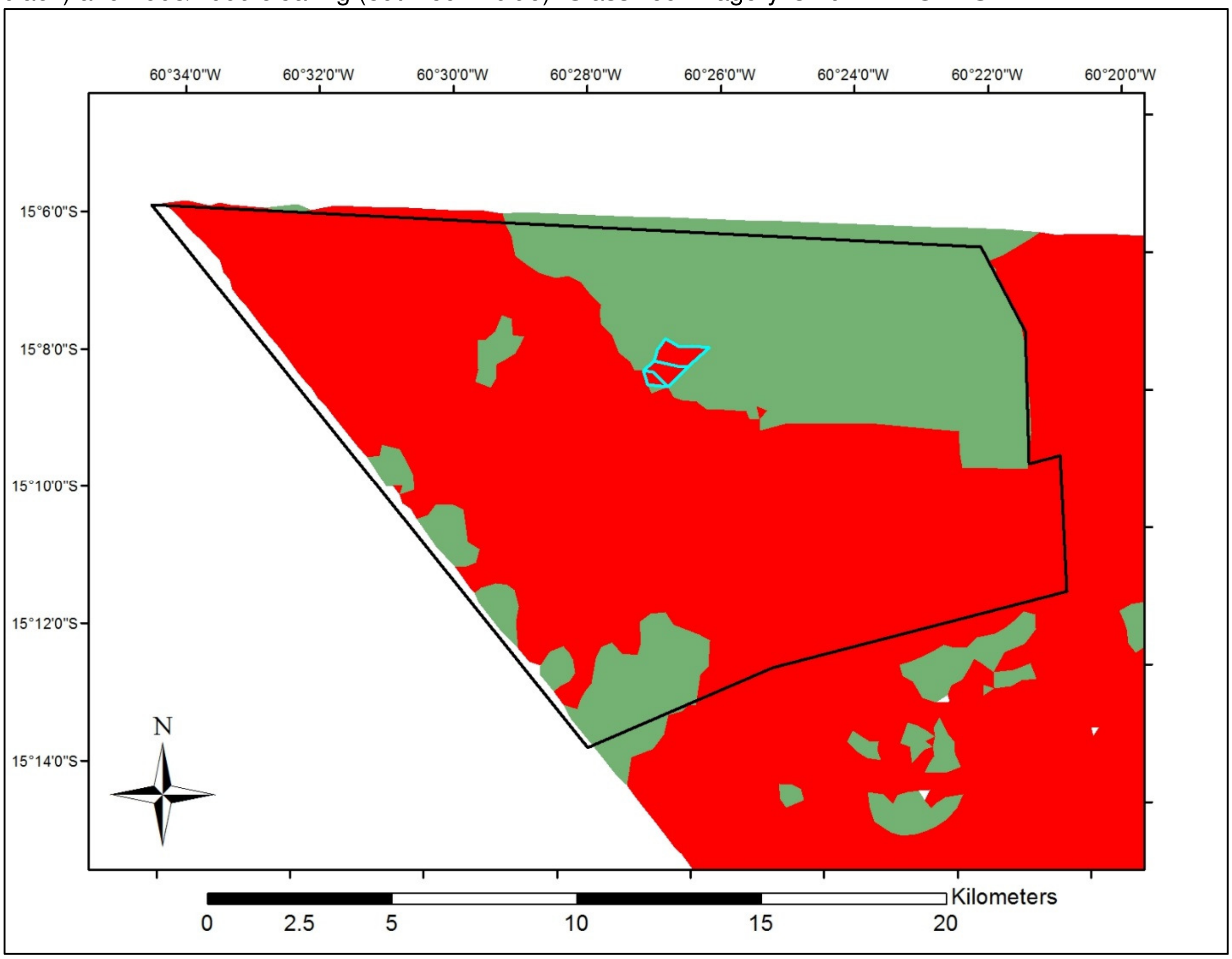
2010 and the parcel opened up the LAR process on 15 April 2011.[43] Approval by INCRA indicates that the delineated boundaries, the legal reserve and APPs have been approved, the CCIR demonstrates all taxes are paid, and the LAR protocol number demonstrates the LAR process has been opened.

3.1.1.4 Evidence of Similar Planned Deforestation Activities by the Baseline Agent

As the agent of deforestation has been identified, JR Agropecuária e Empreendimentos EIRELI, the intent to deforest can be demonstrated by documenting their history of similar planned deforestation within the five years previous to without-project deforestation.

Exhibit D, in the project archive, documents an agreement where Bento hired Ruben's company, Milva Vasques ME, to log and clear part of Fazenda Esperanca, Bento's property, in the State of Mato Grosso, Brazil to establish a cattle ranch, in 2008/2009. This clearing is further substantiated using 2012 PRODES data in Figure 3.3.

Figure 3.3. Forest Cover Map (Green = Forest; Red = Nonforest) with outline of Fazenda Esperanca (in black) and 2008/2009 clearing (outlined in blue). Classified Imagery is 2012 PRODES.

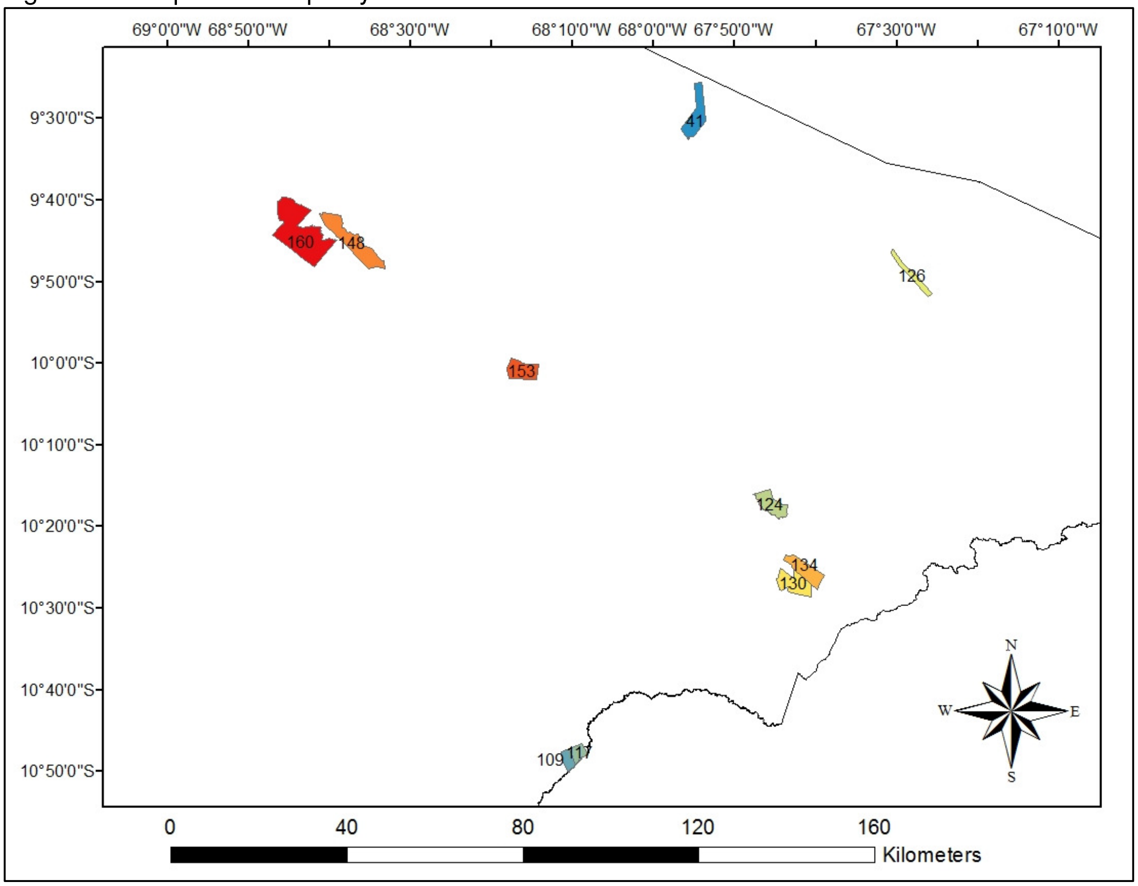


[43] See the project archive for confirmation of the LAR registration.

3.1.2. Identifying proxy areas

Ten areas were identified within Acre State that proved suitable to use as proxy sites from which to estimate rate of planned deforestation in the baseline (see Figure 3.4). Figure 2.2 depicts the deforestation on these properties which occurred from 2002 to 2011.

Figure 3.4. Map of the 10 proxy sites in Acre State.



Each proxy site was selected to meet the following criteria:

1. Land conversion practices are the same as those used by the baseline agent, and are similar on large authorized clearings throughout Acre, typically involving recovery of commercial timber followed by mechanized clearing and burning;

2. The post-deforestation land use is ranching/pasture, the same as the baseline scenario, confirmed via inspection of satellite imagery[44];

3. It has similar management and land use rights as the project area under the business as usual scenario, which are similar on large (>1,000 ha) private holdings throughout Acre (the areas are confirmed to be private lands by process of elimination – i.e. no overlap with GIS layers of state lands, indigenous lands and INCRA settlements;

[44] The boundaries of proxy areas overlaid high resolution aerial photos which depicted features typical of large scale ranches in Acre State, including many cattle trails and ponds.

4. It is located within Acre State;

5. Deforestation is inferred to be legally permitted as the property is fully georeferenced and registered with INCRA and the CAR and under the oversight of the state of Acre;

6. It has deforestation which has occurred within 10 years prior to the baseline period.

The project area is similar in vegetation, elevation, slope, and soil type to each proxy area (See Table 3.1), and hence suitable for conversion to non-forest as these proxy sites have been. Acre State is dominated by open moist tropical forest, which also dominates the project and proxy areas. Note that the vegetation class “other” in most cases represents open forest that has been converted to pasture.

The vast majority of land (and soil) in Acre is suitable for ranching. Pasture can be successfully established on a variety of soils in Acre State, as indicated in Table 3.1. While Gleissolos (Gleysols), and Neossolos (Fluvisol) can support ranching, pasture is not as common on these soil types (as well as Espelho d' agua (Body of water).

All proxies and the project areas were 100% within the 0-500m elevation classes. This is reflective of the fact Acre State has little relief and elevations greater than 500 meters are not common. Similarly, slopes in the proxy site were similar to the project area (predominately <15%).

Table 3.1. Comparison of vegetation, soil type, and vegetation of the project area and proxy sites.

Factors Assessed	**Category**	**Project Area**	**41**	**109**	**117**	**124**	**126**	**130**	**134**	**148**	**153**	**160**
Vegetation (%)												
	Open Forest	100.0%	66.9%	45.9%	75.5%	46.6%	25.3%	7.7%	7.6%	64.2%	67.7%	80.1%
	Dense Forest	0.0%	0.0%	5.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Other	0.0%	33.1%	48.8%	24.5%	53.4%	74.7%	92.3%	92.4%	35.8%	32.3%	19.9%
Elevation (%)												
	0-500m	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Slope (%)												
	Gentle (<15%)	100.0%	100.0%	99.9%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	98.7%
	Steep (>15%)	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.3%
Soil (%)												
	ARGISSOLO	0.0%	100.0%	100.0%	82.4%	93.8%	78.0%	0.0%	0.0%	0.0%	0.0%	89.2%
	CAMBISSOLO	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	ESPELHO D'Agua	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	GLEISSOLO	0.0%	0.0%	0.0%	17.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	LATOSSOLO	0.0%	0.0%	0.0%	0.0%	6.2%	22.0%	100.0%	100.0%	0.0%	0.0%	0.0%
	LUVISSOLO	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%
	NEOSSOLO	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	PLINTOSSOLO	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	10.8%

3.1.3. Rate and Annual area of deforestation cleared in the baseline

The rate of deforestation is calculated for each of the 10 proxy areas using Equation 3.1 and then averaged to derive a baseline rate of deforestation (D%planned,i,t).

Equation 3.1. Equation for estimating the projected annual proportion of land that will be deforested.

$$D\%_{planned,i,t} = \left(\sum_{pn=1}^{n^*} \left(D\%_{pn} \Big/ Yrs_{pn} \right) \right) \Big/ n$$

Table 3.2. Parameters and Values Used to Calculate the projected annual proportion of land that will be deforested.

Parameter	Description	Value	Justification
D%planned,i,t	Projected annual proportion of land that will be deforested in stratum i during year t.	16.1%	Calculated in Table 3.3.
D%pn	Percent of deforestation in land parcel *pn* etc of a proxy area as a result of planned deforestation as defined in this module; %	See Table 3.3.	See project workbook for calculations.
Yrspn	Number of years over which deforestation occurred in land parcel pn in proxy area	See Table 3.3.	See project workbook for calculations.
Aplanned,i, (ha)	Total area of planned deforestation over the baseline period for stratum i; ha	200,000	This is the total area of the project property. In order for Equation 2 to work with Equation 3 of the BL-PL module, both equations need to reference the "proportion of land that will be deforested". This approach is conservative because if the Aplanned was the sum of all areas of planned deforestation, the rate (D% planned) would necessarily be much greater.
L-Di	Likelihood of deforestation for stratum i; %	100%	As the project area is not under government control, "L-Di shall be equal to 100%" as set by the methodology.

AAplanned,i,t	Annual area of baseline planned deforestation for stratum i at time t; ha	See Table 3.3.	Calculated in Table 3.4.

Table 3.3. Calculation of the projected annual proportion of land that will be deforested.

Proxy Site ID	41	109	117	124	126	130	134	148	153	160	Sum/ Average
Area deforested 2002-2011 (Hectares)	941.7	322.6	221.6	514.4	308.5	1,790.0	781.8	1,190.3	558.4	2,227.5	
Parcel Area (Hectares)	3,331.6	1,016.7	1,006.1	2,480.6	1,496.9	3,044.7	2,779.3	5,454.3	2,565.9	10,717.2	
D%pn	28.3%	31.7%	22.0%	20.7%	20.6%	58.8%	28.1%	21.8%	21.8%	20.8%	
Yrspn	2.0	1.0	1.0	3.0	2.0	2.0	2.0	1.0	4.0	4.0	
pn	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
n											10
D%pn/Yrspn	14.1%	31.7%	22.0%	6.9%	10.3%	29.4%	14.1%	21.8%	5.4%	5.2%	
D%planned,i,t											16.1%

The area of land cleared in the baseline is calculated using Equation 3.2. The calculated annual area of planned deforestation, found in Table 3.4, was conservatively adjusted downward (see Table 3.5) due to the impracticality of clearing such a large amount of land at one location in one year. Discussions with Milva Vasquez M.E., a logging company owned by one of the investors in JR Agropecuária e Empreendimentos EIRELI, revealed it was possible to clear up to 8,000-10,000 hectares in any given year. The baseline areas cleared have therefore been adjusted downward, imposing a maximum annual area deforested of 8,000 ha. Note that the calculated baseline applying the methodology yields over 30,000 ha per year. Further, we have conservatively assumed that strata with the lowest carbon stocks are deforested first.

Equation 3.2. Equation for estimating the annual area of planned deforestation in the baseline.

$$AA_{planned,i,t} = \left(A_{planned,i} * D\%_{planned,i,t}\right) * L - D_i$$

Table 3.4. Calculation of the annual area of planned deforestation in the baseline, per methodology.

Year	Aplanned,i, (ha)	D%planned,i,t Actual	L-Di	AAplanned,i,t (ha)
2013	200,000	16.1%	100%	32,205.5
2014	200,000	16.1%	100%	7,095.1
2015	200,000	16.1%	100%	0.0
2016	200,000	16.1%	100%	0.0
2017	200,000	16.1%	100%	0.0
2018	200,000	16.1%	100%	0.0
2019	200,000	16.1%	100%	0.0
2020	200,000	16.1%	100%	0.0
2021	200,000	16.1%	100%	0.0
2022	200,000	16.1%	100%	0.0
Total	200,000			39,300.6

Table 3.5. Conservative planned deforestation baseline, imposing a maximum value of AAplanned,i,t of 8,000 ha.

Year	AAplanned,i,t (ha)	AAplanned,i,t FAP+FAB+FD (ha)	AAplanned,i,t FAP+FAB (ha)	AAplanned,i,t FAB+FAP (ha)	AAplanned,i,t FAB-Aluvial (ha)
2013	8,000	0	5,085	2,915	0
2014	8,000	0	8,000	0	0
2015	8,000	2,780	5,220	0	0
2016	8,000	8,000	0	0	0
2017	7,301	4,020	0	0	3,281
2018	0	0	0	0	0
2019	0	0	0	0	0
2020	0	0	0	0	0

2021	0	0	0	0	0
2022	0	0	0	0	0
Total	39,301	14,800	18,306	2,915	3,281

3.1.4. Estimation of Carbon Stock Changes and GHG Emissions

3.1.4.1 Stratification of the Total Area Subject to Deforestation

The project area was stratified, according to module X-STR, using a vegetation map obtained from the State of Acre.[45] The forest types and strata areas present in the Envira Amazonia Project area are listed in Table 3.6. A map of the vegetation strata in the project area can be found in Figure 1.3.

Table 3.6. Areas of Strata within the Project Area.

Stratum	Stratum Description	Area (hectares)
FAP + FAB + FD	Open forest with palm and bamboo and dense forest	14,800
FAP + FAB	Open forest with palm and bamboo	18,306
FAB + FAP	Open forest with bamboo and palm	2,915
FAB – Aluvial	Open alluvial forest with bamboo	3,281

3.1.4.2 Estimation of Carbon Sequestered in Long-Lived Wood Products

Carbon sequestered in long-lived wood products is calculated using module CP-W Option 2, Commercial Inventory Estimation. The trees harvested would have been made into sawnwood as is typical for the tropical hardwood species in Acre State (Igor Agapejev de Andrade, pers comm.), hence only one wood product class (sawnwood, “s”) is extracted in the baseline. No other wood is extracted for commercial markets. Table 3.7 list all parameters used for CP-W Option 2.

Table 3.7. Parameters and Values used estimate carbon stocks entering the wood products pool.

Parameter	Description	Value	Justification
CXB,sawnwood (t CO2/ha)	Mean stock of extracted biomass carbon by class of wood product *ty* from stratum	36.4	Calculated in Table 3.8.

[45] ACRE. Governo do Estado do Acre. Secretaria de Estado de Planejamento e Desenvolvimento Econômico-Sustentável, Secretaria de Estado de Meio Ambiente e Recursos Naturais. Programa Estadual de Zoneamento Ecológico-Econômico do Acre. Zoneamento Ecológico-Econômico do Acre Fase II. Documento Síntese, 2006.

CAB_tree,I (t CO2/ha)	Mean aboveground biomass carbon stock in stratum i; t CO2-e ha-1	424.8	Calculated from forest inventory data.
BEF	Biomass expansion factor for conversion of volume to total aboveground tree biomass; dimensionless	1.52	BEF calculated using data from the Brazilian Amazon (i.e., country and ecoregion specific) using Higuchi et al. 1998 data (1/0.656=1.524390244).
Pcomi	Commercial volume as a percent of total aboveground volume in stratum i; dimensionless	0.13	1) commercial portion of a tree (.656) x 49.1 tons d.m./ha, total aboveground biomass for commercial species, forest inventory 2) 246.5 tons d.m./ha, average total aboveground biomass, forest inventory
WWs	Wood waste. The fraction immediately emitted through mill inefficiency by class of wood product ty; dimensionless	0.24	Default value for developing countries from CP-W module
CWP,i (t CO2/ha)	Carbon stock entering the wood products pool from stratum *i*;	27.7	Calculated in Table 3.9.
SLFs	SLFty Fraction of wood products that will be emitted to the atmosphere within 5 years of timber harvest by class of wood product ty; dimensionless	0.20	Default for sawnwood from CP-W module
Ofs	OFty Fraction of wood products that will be emitted to the atmosphere between 5 and 100 years of timber harvest by class of wood product ty; dimensionless	0.84	Default value from previous version of methodology module CP-W
CWP100,i (t CO2/ha)	Carbon stock entering the wood products pool at the time of deforestation that is expected to be emitted over 100-years from stratum *i*	24.1	Calculated in Table 3.10.

Equation 3.3. Equation for estimating the mean stock of extracted biomass.

$$C_{XB,i} = C_{AB\_tree,i} * \frac{1}{BCEF} * Pcom_i$$

Table 3.8. Calculation of the mean stock of extracted biomass.

CAB_tree,I (t CO2/ha)	BEF	Pcomi	$C_{XB,sawnwood}$ (t CO2/ha)
425	1.52	0.13	36.4

Equation 3.4. Equation for estimating the carbon stock entering the wood products pool.

$$C_{WP,i} = \sum_{ty=s,w,oir,p,o} C_{XB,ty,i} * (1 - WW_{ty})$$

Table 3.9. Calculation of the carbon stock entering the wood products pool.

$C_{XB,sawnwood}$ (t CO2/ha)	WW_s	$C_{WP,i}$ (t CO2/ha)
36.4	0.24	27.7

Equation 3.5. Carbon stock entering the wood products pool at the time of deforestation that is expected to be emitted over 100-years

$$C_{WP100,i} = C_{WP,i} - C_{WP,i} * (1 - SLFp) * (1 - Ofp)$$

Table 3.10. Carbon stock entering the wood products pool at the time of deforestation that is expected to be emitted over 100-years.

$C_{WP,i}$ (t CO2/ha)	SLF_s	Ofs	$C_{WP100,i}$ (t CO2/ha)
27.7	0.20	0.84	24.1

3.1.4.3 Estimation of Carbon Stocks and Carbon Stock Changes per Stratum

Forest carbon stocks were directly measured in a forest inventory of the Envira Amazonia Project area in 2014. Results are detailed in the “Forest biomass carbon inventory for the Envira Amazonia Project, Acre State, Brazil” 2014 which can be found in the project database. Results are summarized for forest strata in Table 3.11, below. Stratum specific values for live aboveground biomass (CAB_tree,i), belowground biomass, (CBB_tree,i) and dead wood (CDW,i) and stratum totals (CBSL,i) were derived from the forest inventory. The total carbon stock entering the wood products pool ($C_{WP,i}$) and 100-year emissions ($C_{WP100,i}$) can be found in Table 3.7 and were derived using the CP-W module.

After a thorough review of literature, the best source of information on Nonforest biomass stocks was a local study by Salimon et al.[46] entitled “Estimating state-wide biomass carbon stocks for a REDD plan in Acre, Brazil”. This peer reviewed study produced a biomass value for pasture of 16.0 tons d.m./ha and was in part supported by the Acre Environment Office and Fundação de Tecnologia do Estado do Acre. This value was converted to the total aboveground and belowground biomass stock using allometric root equation developed by Cairns[47] and converted to stocks of carbon using a carbon fraction of 0.47, as per the VM007 module. The resulting estimate for post-deforestation pasture CO_2 stocks are listed in Table 3.11.

[46] Salimon et al. 2011. Estimating state-wide biomass carbon stocks for a REDD plan in Acre, Brazil. Forest Ecology and Management 262: 555-560.

[47] Cairns, M. A., S. Brown, E. H. Helmer, and G. A. Baumgardner. 1997. Root biomass allocation in the world’s upland forests. Oecologia 111, 1-11.

Table 3.11. Estimation of Carbon Stocks and Post-Deforestation carbon stocks for all carbon pools and strata.

Stratum	Description	FAP + FAB + FD	FAP + FAB	FAB + FAP	FAB - Aluvial	Area Weighted Mean for the Project Area	Cpost Baseline
CAB_tree,i (t CO2-e ha-1)	Carbon stock in aboveground tree biomass in stratum i; t CO_2e ha-1	431.7	407.3	394.9	518.8	424.8	27.6
CBB_tree,i (t CO2-e ha-1)	Carbon stock in belowground tree biomass in stratum i; t CO_2e ha-1	96.7	91.6	89.1	114.6	95.2	7.6
CDW,i (t CO2-e ha-1)	Carbon stock in dead wood in stratum i; t CO_2e ha-1	18.1	14.3	14.0	22.0	16.4	0.0
CBSL,i (t CO2-e ha-1)	Carbon stock in all carbon pools in forest stratum i; t CO_2e ha-1	546.5	513.2	498.0	655.4	536.5	35.2
$C_{WP,i}$ (t CO2/ha)	Total carbon stock entering the wood products pool at the time of deforestation; t CO2-e ha-1					27.7	
$C_{WP100,i}$ (t CO2/ha)	Carbon stock entering the wood products pool at the time of deforestation that is expected to be emitted over 100-years from stratum i; t CO2-e ha-1					24.1	

Stocks of belowground biomass and dead wood are emitted from the year of conversion/deforestation at a linear rate equal to 1/10 of the initial stock annually, for 10 years. Carbon stocks entering the wood products pool and that are expected to be emitted over 100-years are emitted from the year of conversion/deforestation at a linear rate equal to 1/20 of the initial stock annually, for 20 years. Net emissions (CBSL -C post) from steady decomposition of these pools are elaborated in Tables 3.12, 3.13, and 3.14.

Table 3.12. Emissions from steady decomposition of belowground biomass post deforestation in the project area, ($CBSL_{BB}$ -C $post_{BB}$, t CO2-e).

Year	BGB Emissions from Deforestation (t CO2)	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
2013	664,716	66,472	66,472	66,472	66,472	66,472	66,472	66,472	66,472	66,472	66,472
2014	672,127		67,213	67,213	67,213	67,213	67,213	67,213	67,213	67,213	67,213
2015	686,275			68,627	68,627	68,627	68,627	68,627	68,627	68,627	68,627
2016	712,842				71,284	71,284	71,284	71,284	71,284	71,284	71,284
2017	709,422					70,942	70,942	70,942	70,942	70,942	70,942
2018	0						0	0	0	0	0
2019	0							0	0	0	0
2020	0								0	0	0
2021	0									0	0
2022	0										0
Total		66,472	133,684	202,312	273,596	344,538	344,538	344,538	344,538	344,538	344,538

Table 3.13. Emissions from steady decomposition of dead wood post deforestation in the project area, ($CBSL_{DW}$ -C $post_{DW}$, t CO2-e).

Year	DW Emissions from Deforestation (t CO2)	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
2013	113,793	11,379	11,379	11,379	11,379	11,379	11,379	11,379	11,379	11,379	11,379
2014	114,696		11,470	11,470	11,470	11,470	11,470	11,470	11,470	11,470	11,470
2015	125,225			12,522	12,522	12,522	12,522	12,522	12,522	12,522	12,522
2016	144,995				14,500	14,500	14,500	14,500	14,500	14,500	14,500
2017	145,129					14,513	14,513	14,513	14,513	14,513	14,513
2018	0						0	0	0	0	0
2019	0							0	0	0	0

2020	0								0	0	0
2021	0									0	0
2022	0										0
Total		11,379	22,849	35,371	49,871	64,384	64,384	64,384	64,384	64,384	64,384

Table 3.14. Emissions from steady decomposition of wood products post deforestation in the project area, (C_{WP} -C $post_{WP}$, t CO_2-e).

Year	Wood Product Emissions from Deforestation (t CO2)	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
2013	193,054	9,653	9,653	9,653	9,653	9,653	9,653	9,653	9,653	9,653	9,653
2014	193,054		9,653	9,653	9,653	9,653	9,653	9,653	9,653	9,653	9,653
2015	193,054			9,653	9,653	9,653	9,653	9,653	9,653	9,653	9,653
2016	193,054				9,653	9,653	9,653	9,653	9,653	9,653	9,653
2017	176,176					8,809	8,809	8,809	8,809	8,809	8,809
2018	0						0	0	0	0	0
2019	0							0	0	0	0
2020	0								0	0	0
2021	0									0	0
2022	0										0
Total		9,653	19,305	28,958	38,611	47,420	47,420	47,420	47,420	47,420	47,420

3.1.4.4 Estimation of the Sum of Baseline Carbon Stocks Changes in all pools

Net CO_2 emissions in the baseline for the project area are calculated by summing the net changes in carbon stocks using equation 3.6. The parameters ΔCAB_non-tree, ΔCLI, ΔCBB_non-tree, ΔCSOC have been left out of calculations as they are not included in the project boundary.

Equation 3.6. Equation for estimating the Sum of Baseline Carbon Stocks Changes in all pools.

$$\Delta C_{BSL,i,t} = AA_{planned,i,t} * \left(\Delta C_{ABtree,i} + \Delta C_{ABnon-tree,i} + \Delta C_{LI,i}\right) + \sum_{t-10}^{t}\left(AA_{planned,i,t} * \left(\Delta C_{BBtree,i} + \Delta C_{BBnon-tree,i} + \Delta C_{DW,i}\right) * \frac{1}{10}\right) + \sum_{t-20}^{t}\left(AA_{planned,i,t} * \left(C_{WP100,i} + \Delta C_{SOC,i}\right) * \frac{1}{20}\right)$$

Table 3.15. Calculation of the Sum of Baseline Carbon Stocks Changes in all pools.

Year	AAplanned,i,t FAP+FAB+FD (ha)	AAplanned,i,t FAP+FAB (ha)	AAplanned,i,t FAB+FAP (ha)	AAplanned,i,t FAB-Aluvial (ha)	$CBSL_{AB}$ (t CO2-e)	C $post_{AB}$ (t CO2-e)	$CBSL_{BB}$ - C $post_{BB}$ (t CO2-e)	$CBSL_{DW}$ -C $post_{DW}$ (t CO2-e)	C wp (t CO2-e)	ΔCBSL,i
2013	0	5,085	2,915	0	3,222,159	220,587	66,472	11,379	9,653	3,089,076
2014	0	8,000	0	0	3,258,255	220,587	133,684	22,849	19,305	3,213,507
2015	2,780	5,220	0	0	3,326,003	220,587	202,312	35,371	28,958	3,372,058
2016	8,000	0	0	0	3,453,221	220,587	273,596	49,871	38,611	3,594,712
2017	4,020	0	0	3,281	3,437,097	201,302	344,538	64,384	47,420	3,692,137
2018	0	0	0	0	0	0	344,538	64,384	47,420	456,342
2019	0	0	0	0	0	0	344,538	64,384	47,420	456,342
2020	0	0	0	0	0	0	344,538	64,384	47,420	456,342
2021	0	0	0	0	0	0	344,538	64,384	47,420	456,342
2022	0	0	0	0	0	0	344,538	64,384	47,420	456,342

3.1.4.4 Estimation of GHG Emissions in the Baseline

Greenhouse gas emissions in the baseline resulting from deforestation activities within the project area (GHGBSL,E,i,t) are calculated in Table 3.18 using Equation 3.7. Parameters are found in Table 3.16 and Table 4.3.

Equation 3.7. Equation for Calculating GHG Emissions as a Result of Deforestation Activities within the Project Area in the Project Case.

$GHG_{BSL\text{-}E,i,t} = E_{BiomassBurn,i,t} =$ Aburn,i,t * Bi,t * COMF I * Gg,I * 10^-3 * GWPg

Table 3.16. Parameters and Values Used to Calculate Annual Ex-Ante GHG Emissions.

Parameter	Description	Value	Justification
GHGBSL-E,i,t	Greenhouse gas emissions as a result of deforestation activities within the project boundary in the baseline stratum i during project year t; t CO2-e year-1	See Table 3.18.	Calculated below.
EBiomassBurn,i,t	Non-CO_2 emissions due to biomass burning in stratum i in year t; t CO_2e	See Table 3.18.	Biomass burning is expected to occur in the with project case.

3.1.5. Project Baseline

Net CO_2 emissions in the baseline for the project area are calculated by summing the net changes in GHG emissions and net changes in carbon stocks using equation 3.8.

Equation 3.8. Equation for estimating the baseline net GHG emissions for planned deforestation.

$$\Delta C_{BSL,planned} = \sum_{t=1}^{t*} \sum_{i=1}^{M} \left(\Delta C_{BSL,i,t} + GHG_{BSL-E,i,t} \right)$$

Table 3.17. Parameters and Values used estimating the baseline net GHG emissions for planned deforestation.

Parameter	**Description**	**Value**	**Justification**
ΔCBSL,planned	Net greenhouse gas emissions in the baseline from planned deforestation; t CO2-e	See Table 3.18.	Calculated below.
ΔCBSL,i,t	Net carbon stock changes in all pools in the baseline stratum i at time t; t CO2-e	See Table 3.18.	Calculated above.
GHGBSL-E,i,t	Greenhouse gas emissions as a result of deforestation activities within the project boundary in the baseline stratum i during project year t; t CO2-e year-1	See Table 3.18.	Calculated below.

Table 3.18. Calculation of the baseline net GHG emissions for planned deforestation.

Year	ΔCBSL,i	E-N2O Biomass Burning (tCO2e)	E-CH4 Biomass Burning (tCO2e)	GHGBSL-E,i,t	ΔCBSL,planned
2013	3,089,076	57,146.4	131,621.2	188,768	3,277,844
2014	3,213,507	57,146.4	131,621.2	188,768	3,402,275
2015	3,372,058	57,146.4	131,621.2	188,768	3,560,825
2016	3,594,712	57,146.4	131,621.2	188,768	3,783,480
2017	3,692,137	52,150.4	120,114.2	172,265	3,864,401
2018	456,342	0.0	0.0	0	456,342
2019	456,342	0.0	0.0	0	456,342
2020	456,342	0.0	0.0	0	456,342
2021	456,342	0.0	0.0	0	456,342
2022	456,342	0.0	0.0	0	456,342
Total	19,243,197	280,736	646,599	927,335	20,170,532

3.2 Project Emissions

Expected project emissions are estimated ex-ante and apply Equation 3.9 of module M-MON (VMD0015) of Methodology VM0007. Values for individual parameters are justified in Table 3.19 or derived in Tables 3.20, Table 3.22, and Table 3.24. Ex-ante projections of deforestation in the project case assume no deforestation has taken place as one of the project proponents is the baseline agent of deforestation and has committed to not undertake land clearing on the property.

Equation 3.9. Equation for Calculating the Net GHG emissions within the Project Area under the Project Scenario.

$$\Delta C_P = \sum_{t=1}^{t^*} \sum_{i=1}^{M} \left(\Delta C_{P,DefPA,i,t} + \Delta C_{P,Deg,i,t} + \Delta C_{P,DistPA,i,t} + GHG_{P-E,i,t} - \Delta C_{P,Enh,i,t} \right)$$

Table 3.19. Parameters and Values used to Calculate Annual Ex-Ante Project Emissions.

Parameter	Description	Value	Justification
ΔC_P	Net greenhouse gas emissions within the project area under the project scenario; t CO_2e	See Table 3.20.	Calculated below.
$\Delta C_{P,DefPA,i,t}$	Net carbon stock change as a result of deforestation in the project area in the project case in stratum i at time t; t CO_2e	See Table 3.20.	Calculated below.
$\Delta C_{P,Deg,i,t}$	Net carbon stock change as a result of degradation in the project area in the project case in stratum i at time t; t CO_2e	$\Delta C_{P,Deg,i,t} = 0$	As the agent of deforestation, have committed to not deforest, not harvest fuelwood, and not timber in forests in the project area, and the presence of forest patrols will deter degradation by illegal actors ex-ante degradation is estimated as zero. Emissions resulting from degradation due to selective logging of FSC certified areas (parameter ΔCP,SelLog,i,t) equates to zero as no selective FSC logging occurs in either the baseline or with-project case.
$\Delta C_{P,DistPA,i,t}$	Net carbon stock change as a result of natural disturbance in the project area in the project case in stratum i at time t; t CO_2e	$\Delta C_{P,DistPA,i,t} = 0$	Forests in Acre state have a low incidence of natural disturbance outside of flooding, which does not generally result in tree death and C emissions.
$GHG_{P-E,i,t}$	Greenhouse gas emissions as a result of deforestation and degradation activities within the project area in the project case in stratum i in year t; t CO_2e	See Table 3.20.	Calculated below.

$\Delta C_{P,Enh,i,t}$	Net carbon stock change as a result of forest growth and sequestration during the project in areas projected to be deforested in the baseline in stratum i at time t; t CO_2e	$\Delta C_{P,Enh,i,t} = 0$	Conservative to exclude.

Table 3.20. Data used to Calculate ΔC_P.

Year	ΔCP,DefPA,i,t (t CO2-e)	ΔCP,Deg,i,t (t CO2-e)	ΔCP,DistPA,i,t (t CO2-e)	GHGP-E,i,t (t CO2-e)	ΔCP,Enh,i,t (t CO2-e)	ΔCP (t CO2-e)
2013	0	0	0	0	0	0
2014	0	0	0	0	0	0
2015	0	0	0	0	0	0
2016	0	0	0	0	0	0
2017	0	0	0	0	0	0
2018	0	0	0	0	0	0
2019	0	0	0	0	0	0
2020	0	0	0	0	0	0
2021	0	0	0	0	0	0
2022	0	0	0	0	0	0

Deforestation in the with Project Case

Equation 3.10. Equation for Calculating the Net Carbon Stock Change as a Result of Deforestation in the Project Case.

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

Table 3.21. Parameters and Values used to Calculate Annual Ex-Ante Deforestation Emissions.

Parameter	**Description**	**Value**	**Justification**
ΔCP,DefPA,i,t	Net carbon stock change as a result of deforestation in the project case in the project area in stratum i at time t; t CO_2e	See Table 3.22.	Calculated below.
ADefPA,u,i,t	Area of recorded deforestation in the project area stratum i converted to land use u at time t; ha	See Table 3.22.	Calculated below.
ΔCpools,Def,u,i,t	Net carbon stock changes in all pools in the project case in land use u in stratum i at time t; t CO_2e ha-1	ΔCpools,Def,u,i,t = 536.5	This value is the strata area weighted mean carbon stock in all pools in the baseline case (CBSL,i) minus the carbon stock in all pools in post-deforestation land use (CP,post,u,i) minus the

			carbon stock sequestered in wood products from harvests (CWP,i)

Table 3.22. Data Used to Calculate ΔCP,DefPA,i,t.

Year	ADefPA,u,i,t (ha)	ΔCpools,Def,u,i,t (t CO2-e/ha)	ΔCP,DefPA,i,t (t CO2-e)
2013	0.0	536.5	0
2014	0.0	536.5	0
2015	0.0	536.5	0
2016	0.0	536.5	0
2017	0.0	536.5	0
2018	0.0	536.5	0
2019	0.0	536.5	0
2020	0.0	536.5	0
2021	0.0	536.5	0
2022	0.0	536.5	0

GHG Emissions

Greenhouse gas emissions as a result of deforestation activities within the project area (GHGP,E,i,t) and leakage areas (GHGLK-E,i,t) are similarly expected to be zero, see Table 3.24 and Table 3.25, using Equation 3.11. Parameters are found in Table 3.23 and Table 4.3.

Equation 3.11. Equation for Calculating GHG Emissions as a Result of Deforestation Activities within the Project Area in the Project Case.

$GHG_{P\text{-}E,i,t} = E_{BiomassBurn,i,t} = Aburn,i,t * Bi,t * COMF\ I * Gg,I * 10\text{\^{}-}3 * GWPg$

Table 3.23. Parameters and Values Used to Calculate Annual Ex-Ante GHG Emissions.

Parameter	**Description**	**Value**	**Justification**
GHGP,E,i,t	Greenhouse gas emissions as a result of deforestation activities within the project area in the project case in stratum i in year t; t CO_2e	See Table 3.24.	Calculated below.
EBiomassBurn,i,t	Non-CO_2 emissions due to biomass burning in stratum i in year t; t CO_2e	See Table 3.24.	Biomass burning is expected to occur in the with project case.

Table 3.24. Calculation of $E_{BiomassBurn,i,t}$.. for the project area.

Year	ADefPA,u,i,t (ha)	E-N2O Biomass Burning (tCO2e)	E-CH4 Biomass Burning (tCO2e)	E-Biomass Burning (tCO2e)	GHGP-E,i,t (t CO2-e)
2013	0.0	0.0	0.0	0.0	0.0
2014	0.0	0.0	0.0	0.0	0.0
2015	0.0	0.0	0.0	0.0	0.0
2016	0.0	0.0	0.0	0.0	0.0
2017	0.0	0.0	0.0	0.0	0.0
2018	0.0	0.0	0.0	0.0	0.0
2019	0.0	0.0	0.0	0.0	0.0
2020	0.0	0.0	0.0	0.0	0.0
2021	0.0	0.0	0.0	0.0	0.0
2022	0.0	0.0	0.0	0.0	0.0

Table 3.25. Calculation of $E_{BiomassBurn,i,t}$.. for the leakage areas.

Year	$LKA_{planned}$ (ha)	E-N2O Biomass Burning (tCO2e)	E-CH4 Biomass Burning (tCO2e)	E-Biomass Burning (tCO2e)	GHGLK-E,i,t (t CO2-e)
2013	0.0	0.0	0.0	0.0	0.0
2014	0.0	0.0	0.0	0.0	0.0
2015	0.0	0.0	0.0	0.0	0.0
2016	0.0	0.0	0.0	0.0	0.0
2017	0.0	0.0	0.0	0.0	0.0
2018	0.0	0.0	0.0	0.0	0.0
2019	0.0	0.0	0.0	0.0	0.0
2020	0.0	0.0	0.0	0.0	0.0
2021	0.0	0.0	0.0	0.0	0.0
2022	0.0	0.0	0.0	0.0	0.0

3.3 Leakage

Leakage emissions from displacement of planned deforestation are estimated in conformance with the VCS modular REDD methodology VM0007, specifically the LK-ASP and LK-ME modules. These modules provide for accounting for activity shifting leakage resulting from displacement of deforestation activities by the agent of deforestation and estimating GHG emissions caused by the market-effects leakage related to extraction of wood for timber.

Estimation of Activity Shifting Leakage

Activity shifting leakage due to displacement of planned deforestation was assessed using a series of equations outline in LK-ASP. The primary equations is listed as Equation 3.12.

Equation 3.12. Equation for Estimating Activity Shifting Leakage for Projects Preventing Planned Deforestation.

$$\Delta C_{LK-AS,planned} = \sum_{t=1}^{t^*}\sum_{i=1}^{M}\left(\left(LKA_{planned,i,t} * \Delta C_{BSL,i}\right) + GHG_{LK,E,i,t} + LK_{peat}\right)$$

Table 3.26. Parameters and Values used to Estimate Activity Shifting Leakage for Projects Preventing Planned Deforestation.

Parameter	**Description**	**Value**	**Justification**
ΔCLK-AS,planned	Net greenhouse gas emissions due to activity shifting leakage for projects preventing planned deforestation; t CO2-e	See table below for calculations.	Calculated below.
LKAplanned,i,t	The area of activity shifting leakage in stratum i at time t; ha	See table below for calculations.	Calculated below.
ΔCBSL,i	Net carbon stock changes in all pools in baseline stratum i; t CO2-e ha-1	525.5	Calculated using information from the forest inventory.
GHGLK,E,i,t	Greenhouse gas emissions as a result of leakage of avoided deforestation activities in stratum i in year t; t CO2-e	See Table 3.27.	Calculated in Section 3.2.
LKpeat,t	Net greenhouse gas emissions due to leakage to peatlands as a result of implementation of a planned deforestation project at time t; t CO2-e	0	The agents of deforestation do not own any peatland and hence deforestation will not be displaced to peatlands.

Table 3.27. Calculation of Activity Shifting Leakage for Projects Preventing Planned Deforestation.

Year	LKAplanned (ha)	ΔCBSL,i (t CO2-e/ha)	GHGLK-E,i,t (t CO2-e)	ΔCLK-AS,planned (t CO2-e)
2013	0.0	525.5	0.0	0
2014	0.0	525.5	0.0	0
2015	0.0	525.5	0.0	0
2016	0.0	525.5	0.0	0
2017	0.0	525.5	0.0	0
2018	0.0	525.5	0.0	0
2019	0.0	525.5	0.0	0
2020	0.0	525.5	0.0	0
2021	0.0	525.5	0.0	0
2022	0.0	525.5	0.0	0

Baseline deforestation in the leakage areas is based on Option 1.2[48] of the LK-ASP module and utilizes Equation 3.13 and 3.14. Leakage areas include 11 properties in Brazil owned or managed by the project proponents in Acre and Mato Grosso State, as listed in Table 4.4. As no official records were available, the deforestation agents were surveyed to determine the area cleared by the baseline agent in the five years prior to project implementation.

Equation 3.13. Equation for determining the average area deforested by the baseline agent during the 5 years prior to the project start date.

$$WoPR_{i,t} = \sum_{ag=1}^{ag} \frac{HistHa_{i,ag}}{5}$$

Equation 3.14. Equation for estimating the amount of clearing in the baseline assuming no leakage.

$$NewR_{i,t} = WoPR_{i,t} - \left(D\%_{planned,i,t} * A_{planned,i}\right)$$

With project deforestation in the leakage areas utilizes Equation 3.15, below.

Equation 3.15. Equation for determining the area of shifting leakage in the with project case.

$$LKA_{planned,i,t} = A_{defLK,i,t} - NewR_{i,t}$$

Table 3.28. Parameters and values used to calculate WoPR, NewRi,t, and LKAplanned.

Parameter	**Description**	**Value**	**Justification**
WoPRi,t	Deforestation by the baseline agent of the planned deforestation in the absence of the project in stratum i	See table below for calculations.	Calculated.

[48] The regression equation for Option 1.1 had a very low r2 value and therefore Option 1.1 could not be used.

	in year t; (Under Option 1.2 the same area of deforestation will be applied for each year of the baseline period)		
HistHai,ag	The number of hectares of forest cleared by the baseline agent of the planned deforestation in the five years prior to project implementation in stratum i by agent ag within the country; ha	115.9	Only land cleared owned/managed by landowners and cleared during 5 years prior to the project start date is at Fazenda Esperanca in 2008/2009
NewRi,t	New calculated forest clearance in stratum i at time t by the baseline agent of the planned deforestation where no leakage is occurring; ha	See table below for calculations.	Calculated.
D%planned,i,t x Aplanned,i,	Amount of deforestation in the baseline; ha	Calculated in Table 3.5	See Section 3.1 for details. Values are the same as AAplanned,i,t.
LKAplanned,i,t	The area of activity shifting leakage in stratum i at time t; ha	See table below for calculations.	Calculated.
AdefLK,i,t	The total area of deforestation by the baseline agent of the planned deforestation in stratum i at time, t; ha	0	This parameter is monitored. Ex-ante, it is assumed this value is zero and the agent of deforestation is a project proponent.

Table 3.29. Calculation of WoPR, NewRi,t, and LKAplanned.

Year	WoPRi,t	D%planned,i,t * Aplanned,i	NewRi,t	AdefLK,i,t	$LKA_{planned}$ (ha)
2013	23.2	8,000	0	0	0
2014	23.2	8,000	0	0	0
2015	23.2	8,000	0	0	0
2016	23.2	8,000	0	0	0
2017	23.2	7,301	0	0	0
2018	23.2	0	23	0	0
2019	23.2	0	23	0	0
2020	23.2	0	23	0	0
2021	23.2	0	23	0	0
2022	23.2	0	23	0	0

Estimation of Market Leakage

Market leakage (ΔCLK-ME) is equal to the sum of market effects leakage through decreased timber harvest (LKMarketEffects,timber) and decreased harvest for fuelwood / charcoal production (LKMarketEffects,FW/C). As there is no fuelwood or charcoal collection by the baseline agent of deforestation market leakage is limited to leakage through decreased timber harvest as calculated in Equation 3.16.

Equation 3.16. Equation for Estimation of Market Leakage.

$$\Delta CLK\text{-}ME = LKMarketEffects,timber = \sum_{i=1}^{M}\left(LF_{ME} * AL_{T,i}\right)$$

Table 3.30. Parameters and Values used to Estimation of Market Leakage.

Parameter	Description	Value	Justification
LKMarketEffects, timber	Total GHG emissions due to market- effects leakage through decreased timber harvest; t CO2-e	See Table 3.32.	Calculated below.
LFME	Leakage factor for market-effects calculations; dimensionless	0.4	The market leakage factor, LFME, used for timber is 0.4, where mean merchantable biomass as a proportion of total aboveground tree biomass for each forest type is equal to merchantable biomass as a proportion of total aboveground tree biomass within the project boundary (i.e. similar commercial component of tree structure in the project area as in areas where harvest could be displaced in Brazil to make up for reduction in supply). The species that would be extracted in the project area are Amazonian species, and could only be sourced from other native forest sites in the Brazilian Amazon. They would also need to be sourced from relatively mature forests where millable size trees (> 40 cm DBH) can be readily found. Stem (merchantable portion) biomass as a percent of total aboveground biomass is fairly constant in mature Amazonian forests, averaging around 66% (Higuchi et al 1998), and is not expected to differ between those mature native forests in the project area and in other parts of the Brazilian Amazon.
ALT,i	Summed emissions from timber harvest in stratum *i* in the baseline case potentially displaced through implementation of carbon project; t CO2-e	See Table 3.32.	Calculated below.

The summed emissions from timber harvest in the baseline case potentially displaced through implementation of carbon project (*ALT,i*) is calculated using Equation 3.17.

Equation 3.17. Equation for summing emissions from timber harvest potentially displaced.

$$AL_{T,i} = \sum_{t=1}^{t} \left(C_{BSL,XBT,i,t} \right)$$

The carbon emission due to the displaced logging ($C_{BSL,XBT,i,t}$) has two components: the biomass carbon of the extracted timber and the biomass carbon in the forest damaged in the process of timber extraction. Equation 3.18 is used to calculate $C_{BSL,XBT,i,t}$.

$$C_{BSL,XBT,i,t} = \left(\left[V_{BSL,XE,i,t} * D_{mn} * CF \right] + \left[V_{BSL,XE,i,t} * LDF \right] + \left[V_{BSL,XE,i,t} * LIF \right] \right) * \frac{44}{12}$$

Table 3.31. Parameters and Values used to Estimate Carbon Emission Due to Timber Harvests.

Parameter	**Description**	**Value**	**Justification**
CBSL,XBT,i,t	Carbon emission due to timber harvests in the baseline scenario in stratum i at time t; t CO2-e	See Table 3.32.	Calculated below.
VBSL,EX,i,t	Volume of timber projected to be extracted from within the project boundary during the baseline in stratum i at time t; m3	Calculated	Values calculated using data from the forest inventory. See "Env_ComVol_ 2014.10.21.xls" file in project archive.
Dmn	Mean wood density of commercially harvested species; t d.m.m-3. The value must be the same as that used in the module CP-W if this pool is included in the baseline.	0.74	Value calculated using a combination of project specific data on commercial log volume and estimates of wood density as found in Chave et al. 2006[49]. See "Env_ComVol_ 2015.03.13.xls" file in project archive.
CF	Carbon fraction of biomass for commercially harvested species j; t C t d.m.-1.	0.47	Default value from LK-ME

[49] J. Chave, H. Muller-Landau, T. Baker, T. Easdale, H. ter Steege, CO Webb. 2006. Regional and phylogenetic variation of wood density across 2,456 neotropical tree species. Ecological Applications 16, 2356-2367.

LDF	Logging damage factor; t C m-3 (default 0.53 t C m-3 for broadleaf and mixed forests; 0.25 t C m-3 for coniferous forests)	0.53	Default value from LK-ME
LIF	Logging infrastructure factor; t C m-3 (default 0.29 t C m-3)	0.29	Default value from LK-ME

Table 3.32. Calculation of Market Leakage and Intermediate Parameters.

Year	VBSL,EX,i,t (m3)	CBSL,XBFWC,i,t	ALT,i	LKMarketEffects,timber	LKMarketEffects,FW/C	ΔCLK-ME (t CO2-e)
2013	348,800	1,493,538	1,493,538	597,415	0	597,415
2014	348,800	1,493,538	1,493,538	597,415	0	597,415
2015	348,800	1,493,538	1,493,538	597,415	0	597,415
2016	348,800	1,493,538	1,493,538	597,415	0	597,415
2017	318,306	1,362,966	1,362,966	545,186	0	545,186
2018	0	0	0	0	0	0
2019	0	0	0	0	0	0
2020	0	0	0	0	0	0
2021	0	0	0	0	0	0
2022	0	0	0	0	0	0

Estimation of Net GHG Emissions

Net GHG emissions due to leakage can be estimated using Equation 3.19 and parameters in Table 3.33.

Equation 3.19. Equation for Estimation of Leakage.

$$\Delta C_{LK} = \Delta C_{LK-AS,planned} + \Delta C_{LK-AS,unplanned} + \Delta C_{LK-AS,degrad-FW/C} + \Delta C_{LK-ME}$$

Table 3.33. Parameters and Values used to Estimate Net Leakage.

Parameter	**Description**	**Value**	**Justification**
ΔCLK	Net greenhouse gas emissions due to leakage; t CO_2-e	Calculated in Table 3.34.	Calculated below
ΔCLK-AS, planned	Net greenhouse gas emissions due to activity shifting leakage for projects preventing planned deforestation; t CO_2-e	See Table 3.27.	Calculated above

ΔCLK-AS,unplanned	Net greenhouse gas emissions due to activity shifting leakage for projects preventing unplanned deforestation; t CO_2-e	Not applicable.	Not applicable as this is not an unplanned REDD project.
ΔCLK-ME	Net greenhouse gas emissions due to market-effects leakage; t CO_2-e	See Table 3.32.	Calculated above
ΔCLK- AS,degrad-FW/C	Net greenhouse gas emissions due to activity shifting leakage for degradation caused by extraction of wood for fuel; t CO_2-e	Not applicable.	Any fuelwood and charcoal collected from the project area is sustainable and does not lead to a systematic decrease in carbon stocks over time.

Table 3.34. Calculation of the net GHG emissions due to leakage.

Year	ΔCLK-AS,planned (t CO2-e)	ΔCLK-ME (t CO2-e)	ΔCLK (t CO2-e)
2013	0	597,415	597,415
2014	0	597,415	597,415
2015	0	597,415	597,415
2016	0	597,415	597,415
2017	0	545,186	545,186
2018	0	0	0
2019	0	0	0
2020	0	0	0
2021	0	0	0
2022	0	0	0

3.4 Net GHG Emission Reductions and Removals

Uncertainty will be assessed applying module X-UNC.

Uncertainty in the baseline rate, parameter $Uncertainty_{BSL,RATE}$, is equal to 1.96%. Per the X-UNC module, $Uncertainty_{BSL,RATE}$ has been calculated as “the 95% confidence interval as a percentage of the mean of the area deforested in each proxy (*D%pn*) divided by the number of years over which deforestation occurred in each proxy (*Yrspn*).”

Table 3.35. Calculations of uncertainty in the baseline.

D%pn 95% Confidence Interval as % of mean	Yrspn	UncertaintyBSL,Rate (%)
43.1%	22	1.96%

Total uncertainty in carbon stocks in forest (parameter $Uncertainty_{BSL,SS}$) is equal to combined uncertainty of forest carbon pool stock estimates, calculated using propagation of errors (equation 4 of VM0007 module X-UNC). Parameter $Uncertainty_{BSL,SS}$ is thus calculated to be 4.17% at the 95% confidence level (calculations detailed in Forest Biomass Carbon Inventory Report) for the initial forest inventory. Results of overall uncertainty calculations are presented below in Table 3.36.

Table 3.36. Summary of uncertainty calculations.

X-UNC Equation Number	5		6	10	11
Parameter	$Uncertainty_{BSL,SS}$	$Uncertainty_{BSL,RATE,}$	$Uncertainty_{BSL,t^*}$	C_{REDD_ERROR,t^*}	*Adjustment factor applied to* $C_{REDD,\,t^*}$
Value	4.17%	1.96%	4.61%	4.61%	100%

Estimates of GHG credits eligible for issuance as VCUs were calculated in Table 3.37, below; where

Estimated GHG emission reduction credits =

Baseline emissions, fixed for 10 years at validation *minus*

Project emissions *minus*

Leakage *minus*

Non-permanence Risk Buffer withholding (calculated as a percent of net change in carbon stocks prior to deduction of leakage, see Appendix A).

Table 3.37. Ex-Ante Estimated of Net Emission Reduction Credits.

Years	Estimated baseline emissions or removals (tCO_{2e})	Estimated project emissions or removals (tCO_{2e})	Estimated leakage emissions (tCO_{2e})	Risk buffer (%)	Deductions for AFOLU pooled buffer account (tCO2e)	GHG credits eligible for issuance as VCUs (tCO_{2e})
2013	3,277,844	0	597,415	23%	753,904	1,926,524
2014	3,402,275	0	597,415	23%	782,523	2,022,336
2015	3,560,825	0	597,415	23%	818,990	2,144,420
2016	3,783,480	0	597,415	23%	870,200	2,315,864
2017	3,864,401	0	545,186	23%	888,812	2,430,403
2018	456,342	0	0	23%	104,959	351,383
2019	456,342	0	0	23%	104,959	351,383
2020	456,342	0	0	23%	104,959	351,383
2021	456,342	0	0	23%	104,959	351,383
2022	456,342	0	0	23%	104,959	351,383
Total	20,170,532	0	2,934,848		4,639,222	12,596,462

Over the first 10 year baseline period, the project area is expected to results in 20,170,532 tons CO_2e reductions with a buffer pool contribution of 4,639,222 t CO_2e and a total expected emission reduction of 12,596,462t CO_2e after accounting for leakage (2,934,848 t CO_2e).

Table 3.38. Emissions Reductions (t CO2-e) expected to be generated by the Envira Amazonia Project over the 10 Year Crediting Period.

Aspect of Emission Reductions Estimate	**t CO_2e**
Net forest carbon sequestration (t CO_2) (Baseline-With project scenario)	20,170,532
Buffer pool contribution	4,639,222
Leakage	2,934,848
Total Emission Reductions	12,596,462

4 MONITORING

4.1 Data and Parameters Available at Validation

Data and parameters calculated during the course of project development include those listed in this section.

Data Unit / Parameter:	$\Delta C_{BSL,PAplanned}$
Data unit:	t CO_2-e
Description:	Net greenhouse gas emissions in the baseline from planned deforestation
Source of data:	Derived in Section 3.1 of PD
Value applied:	See Table 3.18
Justification of choice of data or description of measurement methods and procedures applied:	Derived and justified in Section 3 of PD in which baseline is set
Purpose of Data	Calculation of baseline emissions
Comments	

Data Unit / Parameter:	*CF*
Data unit:	t C t^{-1} d.m.
Description:	Carbon fraction of biomass
Source of data:	IPCC 2006GL
Value applied:	0.47
Justification of choice of data or description of measurement methods and procedures applied:	Global default
Purpose of Data	Calculation of baseline emissions
Comments	

Data Unit / Parameter:	fj(X,Y)
Data unit:	t d.m. tree-1
Description:	Allometric equation for species j linking measured tree variable(s) to aboveground biomass of living trees.
Source of data:	Data resulting from the forest inventory.
Value applied:	See forest inventory excel workbook.

Justification of choice of data or description of measurement methods and procedures applied:	The Brown 1997 equation was validated as per methodological guidance. See "Forest biomass carbon inventory for the Russas and Valparaiso Properties, Acre State, Brazil," 2014 for details. Brown, S., 1997. Estimating biomass and biomass change of tropical forests: A primer. FAO Forestry Paper: vii, 55 p.
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Comments	

Data Unit / Parameter:	Root Biomass Density
Data unit:	t d.m. ha-1
Description:	Allometric equation for predicting root biomass density as a function of aboveground biomass density.
Source of data:	Data resulting from the forest inventory.
Value applied:	See forest inventory excel workbook.
Justification of choice of data or description of measurement methods and procedures applied:	Cairns et al. 1997 is a widely accepted peer reviewed scientific publication. Cairns, M. A., S. Brown, E. H. Helmer, and G. A. Baumgardner. 1997. Root biomass allocation in the world's upland forests. Oecologia 111, 1-11.
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Comments	

Data Unit / Parameter:	LIF
Data unit:	t C m-3
Description:	Logging infrastructure factor;
Source of data:	LK-ME
Value applied:	0.29
Justification of choice of data or description of measurement methods and procedures applied:	Default value in LK-ME
Purpose of data	Calculation of leakage emissions
Comments	

Data Unit / Parameter:	BEF
Data unit:	dimensionless
Description:	Biomass expansion factor for conversion of merchantable volume to total aboveground tree biomass
Source of data:	Higuchi et al. 1998 (1/0.656=1.524390244).
Value applied:	1.524390244
Justification of choice of data or description of measurement methods and procedures applied:	BEF calculated using data from the Brazilian Amazon (i.e., country and ecoregion specific)
Purpose of data	Calculation of baseline emissions Calculation of leakage emissions
Comments	This parameter has been calculated as a BEF to fix equation 4 of the CP-W module.

Data Unit / Parameter:	LDF
Data unit:	t C m-3
Description:	Logging damage factor
Source of data:	LK-ME
Value applied:	0.53
Justification of choice of data or description of measurement methods and procedures applied:	Default value for broadleaf and mixed forests in LK-ME
Purpose of data	Calculation of leakage emissions
Comments	

Data Unit / Parameter:	LFME
Data unit:	dimensionless
Description:	Leakage factor for market-effects calculations
Source of data:	LK-ME
Value applied:	0.4
Justification of choice of data or description of measurement methods and procedures applied:	The species that would be extracted in the project area are Amazonian species, and could only be sourced from other native forest sites in the Brazilian Amazon. They would also need to be sourced from relatively mature forests where millable size trees (> 40 cm DBH) can be readily found. Stem (merchantable portion) biomass as a percent of total aboveground biomass is fairly constant in mature Amazonian forests, averaging around 66% (Higuchi et al 1998), and is

	not expected to differ between those mature native forests in the project area and in other parts of the Brazilian Amazon.
Purpose of data	Calculation of leakage emissions
Comments	

Data Unit / Parameter:	SLFs
Data unit:	dimensionless
Description:	Fraction of wood products that will be emitted to the atmosphere within 5 years of timber harvest for sawn wood
Source of data:	CP-W module
Value applied:	0.2
Justification of choice of data or description of measurement methods and procedures applied:	Default value from the CP-W module
Purpose of data	Calculation of baseline emissions Calculation of project emissions Calculation of leakage emissions
Comments	

Data Unit / Parameter:	OFts
Data unit:	dimensionless
Description:	Fraction of wood products that will be emitted to the atmosphere between 5 and 100 years of timber harvest for sawn wood
Source of data:	CP-W module
Value applied:	0.84
Justification of choice of data or description of measurement methods and procedures applied:	Default value from the CP-W module
Purpose of data	Calculation of baseline emissions Calculation of project emissions Calculation of leakage emissions
Comments	

Data Unit / Parameter:	WWs
Data unit:	dimensionless
Description:	The fraction immediately emitted through mill

	inefficiency for sawn wood
Source of data:	CP-W module
Value applied:	0.24
Justification of choice of data or description of measurement methods and procedures applied:	Default value from the CP-W module
Purpose of data	Calculation of baseline emissions Calculation of project emissions Calculation of leakage emissions
Comments	

Data Unit / Parameter:	VBSL,EX,i,t
Data unit:	m^3
Description:	Volume of timber projected to be extracted from within the project boundary during the baseline in stratum i at time t
Source of data:	Calculated
Value applied:	(see table below)
Justification of choice of data or description of measurement methods and procedures applied:	Derived using Equation 4 of the LK-ME module
Purpose of data	Calculation of leakage emissions
Comments	None

Year	VBSL,EX,i,t (m3)
2013	348,800
2014	348,800
2015	348,800
2016	348,800
2017	318,306
2018	0
2019	0
2020	0
2021	0
2022	0

Data Unit / Parameter:	Dmn
Data unit:	t d.m. m-3

Description:	Mean wood density of commercially harvested species
Source of data:	Calculated
Value applied:	0.74
Justification of choice of data or description of measurement methods and procedures applied:	This value uses site specific data on commercial log volume and estimates of wood density as found in Chave et al. 2006.
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Comments	Value calculated using a combination of project specific data on commercial log volume and estimates of wood density as found in Chave et al. 2006. See "Env_ComVol_ 2015.03.13.xls" file in project archive.

Data Unit / Parameter:	PMLFT
Data unit:	%
Description:	Mean merchantable biomass as a proportion of total aboveground tree biomass for each forest type
Source of data:	Feldpausch, T. R., McDonald, A. J., Passos, C. A., Lehmann, J., & Riha, S. J. (2006). Biomass, harvestable area, and forest structure estimated from commercial timber inventories and remotely sensed imagery in southern Amazonia. *Forest Ecology and Management*, *233*(1), 121-132
Value applied:	8%-12%
Justification of choice of data or description of measurement methods and procedures applied:	Volumetric weighted wood density as suggested by the methodology and volume by species.
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Comments	None

4.2 Data and Parameters Monitored

Data and parameters which will need to be monitored include those listed in this section. Details on data and parameters monitored are provided below.

Data Unit / Parameter:	$\Delta C_{P,Def,i,t}$
Data unit:	t CO_2-e

Description:	Net carbon stock change as a result of deforestation in the project case in the project area in stratum i at time t
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	As this parameter was calculated rather than measured, no measurements methods are noted. Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Every ≤ 5 years
Value applied:	<table><tr><th>Year</th><th>ΔCP,DefPA,i,t (t CO2-e)</th></tr><tr><td>2013</td><td>0</td></tr><tr><td>2014</td><td>0</td></tr><tr><td>2015</td><td>0</td></tr><tr><td>2016</td><td>0</td></tr><tr><td>2017</td><td>0</td></tr><tr><td>2018</td><td>0</td></tr><tr><td>2019</td><td>0</td></tr><tr><td>2020</td><td>0</td></tr><tr><td>2021</td><td>0</td></tr><tr><td>2022</td><td>0</td></tr></table>
Monitoring equipment:	None.
QA/QC procedures to be applied:	Neither QA/QC procedures nor calibration are relevant for this calculated parameter.
Purpose of data	Calculation of project emissions
Calculation method:	Equation 3, VMD0015
Comments	None

Data Unit / Parameter:	$\Delta C_{P,DistPA,i,t}$
Data unit:	t CO_2-e
Description:	Net carbon stock change as a result of natural disturbance in the project case in the project area in stratum i at time t
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	As this parameter was calculated rather than measured, no measurements methods are noted. Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Every ≤ 5 years
Value applied:	<table><tr><th>Year</th><th>ΔCP,DistPA,i,t (t CO2-e)</th></tr><tr><td>2013</td><td>0</td></tr></table>

	2014 — 0 2015 — 0 2016 — 0 2017 — 0 2018 — 0 2019 — 0 2020 — 0 2021 — 0 2022 — 0
Monitoring equipment:	None.
QA/QC procedures to be applied:	Neither QA/QC procedures nor calibration are relevant for this calculated parameter.
Purpose of data	Calculation of project emissions
Calculation method:	Equation 20, VMD0015
Comments	None

Data Unit / Parameter:	$A_{DefPA,u,i,t}$
Data unit:	Ha
Description:	Area of recorded deforestation in the project area stratum i converted to land use u at time t
Source of data:	Monitored at each monitoring/verification event through the use of classified satellite imagery
Description of measurement methods and procedures to be applied:	Detailed procedures are provided below under monitoring plan description. Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Every $\leq$ 5 years
Value applied:	See Table 3.20
Monitoring equipment:	ArcGIS
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description
Purpose of data	Calculation of project emissions
Calculation method:	Not relevant
Comments	None

Data Unit / Parameter:	$A_{DefLK,,i,t}$
Data unit:	Ha
Description:	The total area of deforestation by the baseline agent of the planned deforestation in stratum I at time, t

Source of data:	Monitored at each monitoring/verification
Description of measurement methods and procedures to be applied:	Detailed procedures are provided below under monitoring plan description. Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Every $\leq$ 5 years
Value applied:	0
Monitoring equipment:	ArcGIS
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description
Purpose of data	Calculation of leakage emissions
Calculation method:	Not relevant
Comments	This parameter is monitored. Ex-ante, it is assumed this value is zero and the agent of deforestation is a project proponent.

Data Unit / Parameter:	$A_{DistPA,q,i,t}$
Data unit:	ha
Description:	Area impacted by natural disturbance in post-natural disturbance stratum q in stratum i, at time t
Source of data:	Monitored at each monitoring/verification event through the use of classified satellite imagery
Description of measurement methods and procedures to be applied:	Detailed procedures provided below under monitoring plan description. Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Every $\leq$ 5 years
Value applied:	Year / $A_{DistPA,q,i,t}$: 2013: 0 2014: 0 2015: 0 2016: 0 2017: 0 2018: 0 2019: 0 2020: 0 2021: 0 2022: 0
Monitoring equipment:	ArcGIS

QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description
Purpose of data	Calculation of project emissions
Calculation method:	Not relevant
Comments	None

Data Unit / Parameter:	$C_{BSL,i}$
Data unit:	t CO_2-e ha^{-1}
Description:	Carbon stock in all pools in the baseline case in stratum i
Source of data:	Estimated from forest carbon inventory.
Description of measurement methods and procedures to be applied:	Detailed procedures provided below under monitoring plan description Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Every $\leq$ 10 years.
Value applied:	Strata / CBSL,i (t CO2-e ha-1): FAP + FAB + FD: 546.5 FAP + FAB: 513.2 FAB + FAP: 498.0 FAB - Aluvial: 655.4
Monitoring equipment:	dbh tape, measuring tape, GPS, clinometer
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Calculation method:	Use equations as stated in the forest inventory, including allometric equations as found in Brown (1997), a volumetric based palm equation, Cairns et al. (1997), Van Wagner (1968)
Comments	None

Data Unit / Parameter:	ΔCpools,Def,u,i,t
Data unit:	t CO_2-e ha^{-1}
Description:	Net carbon stock changes in all pools in the project case in land use u in stratum i at time t
Source of data:	Calculated.

Description of measurement methods and procedures to be applied:	As this parameter was calculated rather than measured, no measurements methods are noted. Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Every $\leq$ 10 years.
Value applied:	536.5
Monitoring equipment:	None.
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Calculation method:	Equation 5, VMD0015
Comments	None

Data Unit / Parameter:	$A_{DegW,i,t}$
Data unit:	ha
Description:	Area potentially impacted by degradation processes in stratum i
Source of data:	Delineated based on survey results indicating general area of project potentially accessed and typical depth of penetration of illegal harvest activities from points of access.
Description of measurement methods and procedures to be applied:	Detailed procedures provided below under monitoring plan description. Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Repeated each time the PRA indicates a potential for degradation. PRA conducted every $\leq$ 2 years
Value applied:	0
Monitoring equipment:	None.
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description.
Purpose of data	Calculation of project emissions
Calculation method:	Not relevant
Comments	PRAs indicated no degradation

Data Unit / Parameter:	$C_{DegW,i,t}$
Data unit:	t CO_2-e

Description:	Biomass carbon of trees cut and removed through degradation process from plots measured in stratum i at time t
Source of data:	Estimated from diameter measurements of cut stumps in sample plots
Description of measurement methods and procedures to be applied:	Detailed procedures provided below under monitoring plan description. Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Every $\leq$ 5 years where surveys and limited sampling continue to indicate possibility of illegal logging in the project area
Value applied:	0
Monitoring equipment:	None.
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description.
Purpose of data	Calculation of project emissions
Calculation method:	Equation 8, VMD0015
Comments	PRAs indicated no degradation

Data Unit / Parameter:	AP_i
Data unit:	ha
Description:	Total area of degradation sample plots in stratum i
Source of data:	Calculated as 3% of $A_{DegW,i,t}$
Description of measurement methods and procedures to be applied:	Detailed procedures provided below under monitoring plan description. Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Every $\leq$ 5 years where surveys and limited sampling continue to indicate possibility of illegal logging in the project area
Value applied:	To be determined
Monitoring equipment:	ArcGIS
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description.
Purpose of data	Calculation of project emissions
Calculation method:	Not relevant
Comments	None

Data Unit / Parameter:	$\Delta C_{P,Deg,i,t}$
Data unit:	t CO_2-e
Description:	Net carbon stock changes as a result of degradation in stratum i in the project area at time t
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	As this parameter was calculated rather than measured, no measurements methods are noted. Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Every $\leq$ 5 years where surveys and limited sampling continue to indicate possibility of illegal logging in the project area
Value applied:	0
Monitoring equipment:	None
QA/QC procedures to be applied:	Neither QA/QC procedures nor calibration are relevant for this calculated parameter.
Purpose of data	Calculation of project emissions
Calculation method:	Equation 8, VMD0015
Comments	PRAs indicated no degradation

Data Unit / Parameter:	Aburn,q,i,t.
Data unit:	ha
Description:	Area burnt in post-natural disturbance stratum q in stratum i, at time t;
Source of data:	See parameter $A_{DistPA,q,i,t}$ and ADefPA,u,i,t
Description of measurement methods and procedures to be applied:	Monitored as part of $A_{DistPA,q,i,t}$ Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Every $\leq$ 5 years
Value applied:	(see table below)

Year	Aburn,q,i,t. (ha)
2013	0
2014	0
2015	0
2016	0
2017	0
2018	0
2019	0
2020	0
2021	0

	2022 | 0
Monitoring equipment:	None.
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description
Purpose of data	Calculation of project emissions
Calculation method:	Aburn,q,i,t.= = $A_{DistPA,q,i,t}$ (area burnt in natural disturbance) + ADefPA,u,i,t (area burnt via deforestation in project ex post)
Comments	None

Data Unit / Parameter:	dbh
Data unit:	cm
Description:	diameter at breast height
Source of data:	Monitored during the course of each forest inventory
Description of measurement methods and procedures to be applied:	Detailed procedures provided below in Appendix B Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Every $\leq$ 10 years
Value applied:	See forest inventory excel sheet.
Monitoring equipment:	dbh tape, measuring tape,
QA/QC procedures to be applied:	Detailed procedures are provided below under monitoring plan description.
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Calculation method:	Not relevant
Comments	None

Data Unit / Parameter:	dbasal
Data unit:	cm
Description:	Basal diameter
Source of data:	Monitored during the course of each forest inventory
Description of measurement methods and procedures to be applied:	Detailed procedures provided below in Appendix B Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Every $\leq$ 10 years

Value applied:	See forest inventory excel sheet.
Monitoring equipment:	dbh tape, measuring tape,
QA/QC procedures to be applied:	Detailed procedures are provided below under monitoring plan description.
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Calculation method:	Not relevant
Comments	Dbh may be used as a conservative estimate of dbasal

Data Unit / Parameter:	H
Data unit:	m
Description:	Height of tree
Source of data:	Monitored during the course of each forest inventory
Description of measurement methods and procedures to be applied:	Detailed procedures provided below in Appendix B Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Every $\leq$ 10 years
Value applied:	See forest inventory excel sheet.
Monitoring equipment:	measuring tape, clinometer
QA/QC procedures to be applied:	Detailed procedures are provided below under monitoring plan description.
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Calculation method:	Not relevant
Comments	None

Data Unit / Parameter:	Dn
Data unit:	cm
Description:	Diameter of piece n of dead wood along the transect
Source of data:	Monitored during the course of each forest inventory
Description of measurement methods and procedures to be applied:	Detailed procedures provided below in Appendix B Monitoring responsibilities are listed in section 4.3, below.

Frequency of monitoring/recording:	Every ≤ 10 years
Value applied:	See forest inventory excel sheet.
Monitoring equipment:	dbh tape, measuring tape
QA/QC procedures to be applied:	Detailed procedures are provided below under monitoring plan description.
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Calculation method:	Not relevant
Comments	None

Data Unit / Parameter:	N
Data unit:	dimensionless
Description:	Total number of wood pieces intersecting the transect
Source of data:	Monitored during the course of each forest inventory
Description of measurement methods and procedures to be applied:	Detailed procedures provided below in Appendix B Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Every ≤ 10 years
Value applied:	See forest inventory excel sheet.
Monitoring equipment:	None
QA/QC procedures to be applied:	Detailed procedures are provided below under monitoring plan description.
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Calculation method:	Not relevant
Comments	None

Data Unit / Parameter:	L
Data unit:	m
Description:	Length of the transect
Source of data:	Monitored during the course of each forest inventory
Description of measurement methods and procedures to be applied:	Detailed procedures provided below in Appendix B Monitoring responsibilities are listed in section 4.3, below.

Frequency of monitoring/recording:	Every ≤ 10 years
Value applied:	184 m
Monitoring equipment:	measuring tape,
QA/QC procedures to be applied:	Detailed procedures are provided below under monitoring plan description.
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Calculation method:	Not relevant
Comments	None

Data Unit / Parameter:	$U_{P,SS,i,pool\#}$
Data unit:	%
Description:	Percentage uncertainty (expressed as 95% confidence interval as a percentage of the mean where appropriate) for carbon stocks and greenhouse gas sources in the with-project case (1,2…n represent different carbon pools and/or GHG sources)
Source of data:	Calculations arising from field measurement data
Description of measurement methods and procedures to be applied:	Uncertainty in pools derived from field measurement with 95% confidence interval calculated as the standard error of the averaged plot measurements in each stratum multiplied by the t value for the 95% confidence level. Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Monitored at least once every 10 years (on re-measurement of forest carbon stocks)
Value applied:	Same as UBSL,SS,i,pool# values below.
Monitoring equipment:	None
QA/QC procedures to be applied:	Neither QA/QC procedures nor calibration are relevant for this calculated parameter.
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Calculation method:	Not relevant
Comments	Same as UBSL,SS,i,pool# values below as forest carbon stock growth was not tracked.

Data Unit / Parameter:	EBSL SS,i, pool#
Data unit:	t CO2-e
Description:	Carbon stock or GHG sources (e.g. trees, dead wood, soil organic carbon, emission from fertilizer addition, emission from biomass burning etc.) in the baseline case
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	As this parameter was calculated rather than measured, no measurements methods are noted. Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Every ≤ 10 years.
Value applied:	(see table below)
Monitoring equipment:	None
QA/QC procedures to be applied:	Neither QA/QC procedures nor calibration are relevant for this calculated parameter.
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Calculation method:	Not relevant
Comments	Baseline stocks and sources are estimated ex-ante for each baseline period

Strata	Live aboveground tree biomass	Belowground biomass	Standing dead wood	Lying dead wood
FAP + FAB + FD	6,388,286	1,430,909	25,996	242,238
FAP + FAB	7,455,498	1,676,716	56,615	205,832
FAB + FAP	1,150,968	259,555	9,093	31,791
FAB - Aluvial	1,701,983	376,116	38,440	33,835

Data Unit / Parameter:	UBSL,SS,i,pool#
Data unit:	%
Description:	Percentage uncertainty (expressed as 95% confidence interval as a percentage of the mean where appropriate) for carbon stocks and greenhouse gas sources in the baseline case (1,2…n represent different carbon pools and/or GHG sources)
Source of data:	Calculated

Description of measurement methods and procedures to be applied:	As this parameter was calculated rather than measured, no measurements methods are noted. Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Every $\leq$ 10 years.
Value applied:	(see table below)
Monitoring equipment:	None
QA/QC procedures to be applied:	Neither QA/QC procedures nor calibration are relevant for this calculated parameter.
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Calculation method:	See equation 4 in the X-UNC module.
Comments	Baseline stocks and sources are estimated ex-ante for each baseline period

Value applied:

Strata	Live aboveground tree biomass	Belowground biomass	Standing dead wood	Lying dead wood
FAP + FAB + FD	6.6%	6.1%	52.2%	76.8%
FAP + FAB	9.1%	8.4%	43.5%	37.2%
FAB + FAP	13.9%	12.9%	222.6%	66.6%
FAB - Aluvial	10.2%	9.4%	264.1%	122.0%

Data Unit / Parameter:	EBSL SS,i
Data unit:	t CO2-e
Description:	Sum of combined carbon stocks and GHG sources in stratum i multiplied by the area of stratum i (Ai) in the baseline case
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	As this parameter was calculated rather than measured, no measurements methods are noted. Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Every $\leq$ 10 years.
Value applied:	(see table below)

Value applied:

Strata	**EBSL,SS,t,I (tCO2e)**
FAP + FAB + FD	8,087,429
FAP + FAB	9,394,661

	FAB + FAP: 1,451,406 FAB - Aluvial: 2,150,373
Monitoring equipment:	None
QA/QC procedures to be applied:	Neither QA/QC procedures nor calibration are relevant for this calculated parameter.
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Calculation method:	Not relevant
Comments	Baseline stocks and sources are estimated ex-ante for each baseline period

Data Unit / Parameter:	UBSL,SS,i
Data unit:	%
Description:	Percentage uncertainty in the combined carbon stocks and greenhouse gas sources in stratum i in the baseline case
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	As this parameter was calculated rather than measured, no measurements methods are noted. Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Every ≤ 10 years.
Value applied:	**Strata** / **UncertaintyBSL,SS,I (%)** FAP + FAB + FD: 5.8% FAP + FAB: 7.4% FAB + FAP: 11.4% FAB - Aluvial: 9.7%
Monitoring equipment:	None
QA/QC procedures to be applied:	Neither QA/QC procedures nor calibration are relevant for this calculated parameter.
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Calculation method:	See equation 5 in the X-UNC module.
Comments	Baseline stocks and sources are estimated ex-ante for each baseline period

Data Unit / Parameter:	Bi,t
Data unit:	tonnes d. m. ha-1
Description:	Average aboveground biomass stock before burning stratum i, time t
Source of data:	Calculated using forest inventory data
Description of measurement methods and procedures to be applied:	Detailed forest inventory procedures are provided in Appendix B of the project document. Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Every ≤ 10 years
Value applied:	Bi,t (tonnes d.m./ha) Ex-ante Project Area: 256.0
Monitoring equipment:	None
QA/QC procedures to be applied:	Detailed procedures are provided below under monitoring plan description.
Purpose of data	Calculation of baseline emissions Calculation of project emissions Calculation of leakage
Calculation method:	Use equations as stated in the forest inventory, including allometric equations as found in Brown (1997) and a volumetric based palm equation, Van Wagner (1968)
Comments	Ex-ante Bi,t is the weighted average across all strata

Data Unit / Parameter:	AGB
Data unit:	tonnes d. m. ha-1
Description:	Aboveground biomass density
Source of data:	Calculated using forest inventory data
Description of measurement methods and procedures to be applied:	Detailed forest inventory procedures are provided in Appendix B of the project document. Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Every ≤ 10 years
Value applied:	Plot level values can be found in the Forest Inventory Report
Monitoring equipment:	None
QA/QC procedures to be applied:	Detailed procedures are provided below under monitoring plan description.
Purpose of data	Calculation of baseline emissions Calculation of project emissions

Calculation method:	Use equations as stated in the forest inventory, including allometric equations as found in Brown (1997) and a volumetric based palm equation, Van Wagner (1968)
Comments	None

Data Unit / Parameter:	Asp
Data unit:	ha
Description:	Area of sample plots in ha
Source of data:	Recording and archiving of number and size of sample plots
Description of measurement methods and procedures to be applied:	Detailed forest inventory procedures are provided in Appendix B of the project document. Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Every $\leq$ 10 years
Value applied:	0.16619 ha or a 23m radius circle
Monitoring equipment:	m
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Calculation method:	Not relevant
Comments	None

Data Unit / Parameter:	Hsdw
Data unit:	m
Description:	Height of standing dead tree in m
Source of data:	Monitored during the course of each forest inventory
Description of measurement methods and procedures to be applied:	Detailed procedures provided below in Appendix B. Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Every $\leq$ 10 years
Value applied:	See forest inventory excel workbook.
Monitoring equipment:	measuring tape, clinometer
QA/QC procedures to be applied:	Detailed procedures are provided below under monitoring plan description.
Purpose of data	Calculation of baseline emissions

	Calculation of project emissions
Calculation method:	Not relevant
Comments	None

Data Unit / Parameter:	DDWdc
Data unit:	t d.m. m-3
Description:	Mean wood density of dead wood in the density class (dc) – sound (1),intermediate (2), and rotten (3); t d.m. m-3
Source of data:	Monitored during the course of each forest inventory
Description of measurement methods and procedures to be applied:	Detailed procedures provided below in Appendix B. Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Every $\leq$ 10 years
Value applied:	<table><tr><th>Density Class</th><th>Density (t d.m. m-3)</th></tr><tr><td>Rotten (P)</td><td>0.131</td></tr><tr><td>Intermediary (I)</td><td>0.382</td></tr><tr><td>Solid (S)</td><td>0.517</td></tr></table>
Monitoring equipment:	dbh tape, measuring tape, drying oven
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Calculation method:	Not relevant
Comments	None

Data Unit / Parameter:	CP,Dist,q,i
Data unit:	t CO2-e ha-1
Description:	Carbon stock in all pools in post-natural disturbance q in baseline stratum i
Source of data:	Monitored
Description of measurement methods and procedures to be applied:	Detailed procedures provided below in Appendix B. Monitoring responsibilities are listed in section 4.3, below.
Frequency of monitoring/recording:	Prior to each verification event and at least every 5 years.
Value applied:	0
Monitoring equipment:	dbh tape, measuring tape, GPS, clinometer

QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description
Purpose of data	Calculation of project emissions
Calculation method:	Use equations as stated in the forest inventory, including allometric equations as found in Brown (1997) and a volumetric based palm equation, Cairns et al. (1997), Van Wagner (1968). Carbon stocks must be measured and estimated using the methods given in module CP-AB and CP-D.
Comments	Alternatively, it can be conservatively assumed that a post-natural disturbance live and dead vegetation pool is equal to zero

Data Unit / Parameter:	Ai
Data unit:	ha
Description:	Total area of stratum i
Source of data:	GIS coverages
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Every $\leq$ 10 years
Value applied:	see table below
Monitoring equipment:	ArcGIS
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description
Purpose of data	Calculation of baseline emissions Calculation of project emissions Calculation of leakage
Calculation method:	N/A
Comments	*Ex-ante,* it shall be assumed that stratum area will remain constant for the baseline period

Value applied:

Strata in Project	Ai (ha)
FAP + FAB + FD	14,800
FAP + FAB	18,306
FAB + FAP	2,915
FAB - Aluvial	3,281

Data Unit / Parameter:	AAplanned,i,t
Data unit:	ha
Description:	Annual area of baseline planned deforestation for stratum i at time t
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Every $\leq$ 10 years
Value applied:	<table><tr><td>Year</td><td>Actual AAplanned,i,t</td><td>Conservative AAplanned,i,t</td></tr><tr><td>2013</td><td>32,205</td><td>8,000</td></tr><tr><td>2014</td><td>7,095</td><td>8,000</td></tr><tr><td>2015</td><td>0</td><td>8,000</td></tr><tr><td>2016</td><td>0</td><td>8,000</td></tr><tr><td>2017</td><td>0</td><td>7,301</td></tr><tr><td>2018</td><td>0</td><td>0</td></tr><tr><td>2019</td><td>0</td><td>0</td></tr><tr><td>2020</td><td>0</td><td>0</td></tr><tr><td>2021</td><td>0</td><td>0</td></tr><tr><td>2022</td><td>0</td><td>0</td></tr></table>
Monitoring equipment:	N/A
QA/QC procedures to be applied:	N/A
Purpose of data	Calculation of baseline emissions
Calculation method:	Uses Equation 3 in BL-PL
Comments	None

Data Unit / Parameter:	Aplanned,i
Data unit:	ha
Description:	Total area of planned deforestation over the baseline period for stratum i
Source of data:	Monitored
Description of measurement methods and procedures to be applied:	Determined using a GIS
Frequency of monitoring/recording:	Every $\leq$ 10 years

Value applied:	200,000
Monitoring equipment:	GIS
QA/QC procedures to be applied:	None
Purpose of data	Calculation of baseline emissions
Calculation method:	N/A
Comments	This is the total area of the project property.

Data Unit / Parameter:	ALT,i
Data unit:	t CO2-e
Description:	Summed emissions from timber harvest in stratum i in the baseline case potentially displaced through implementation of carbon project
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Every $\leq$ 10 years
Value applied:	Year / ALT,i: 2013: 1,493,538; 2014: 1,493,538; 2015: 1,493,538; 2016: 1,493,538; 2017: 1,362,966; 2018: 0; 2019: 0; 2020: 0; 2021: 0; 2022: 0
Monitoring equipment:	N/A
QA/QC procedures to be applied:	N/A
Purpose of data	Calculation of leakage emissions
Calculation method:	Equation 3 in LK-ME
Comments	None

Value applied (ALT,i):

Year	ALT,i
2013	1,493,538
2014	1,493,538
2015	1,493,538
2016	1,493,538
2017	1,362,966
2018	0
2019	0
2020	0
2021	0
2022	0

Data Unit / Parameter:	CXB,sawnwood
Data unit:	t CO2-e
Description:	Carbon emission due to displaces timber harvests in the baseline scenario in stratum in time t
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Every ≤ 10 years
Value applied:	Year / CBSL,XBFWC,i,t: 2013: 348,800 2014: 348,800 2015: 348,800 2016: 348,800 2017: 318,306 2018: 0 2019: 0 2020: 0 2021: 0 2022: 0
Monitoring equipment:	N/A
QA/QC procedures to be applied:	N/A
Purpose of data	Calculation of leakage emissions
Calculation method:	Equation 4 in LK-ME
Comments	None

Data Unit / Parameter:	Pcomi
Data unit:	dimensionless
Description:	Commercial volume as a percent of total aboveground volume in stratum i
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Every ≤ 10 years
Value applied:	0.13
Monitoring equipment:	N/A

QA/QC procedures to be applied:	N/A
Purpose of data	Calculation of baseline emissions Calculation of project emissions Calculation of leakage
Calculation method:	1) commercial portion of a tree (.656) x 49.1 tons d.m./ha, total aboveground biomass for commercial species, forest inventory 2) 246.5 tons d.m./ha, average total aboveground biomass, forest inventory
Comments	None

Data Unit / Parameter:	CWP100,i
Data unit:	t CO2/ha
Description:	Carbon stock entering the wood products pool at the time of deforestation that is expected to be emitted over 100-years from stratum *i*; t CO2-e ha-1
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Every $\leq$ 10 years
Value applied:	24.1
Monitoring equipment:	N/A
QA/QC procedures to be applied:	N/A
Purpose of data	Calculation of baseline emissions Calculation of project emissions Calculation of leakage
Calculation method:	Uses Equation 2 in the CP-W module
Comments	None

Data Unit / Parameter:	CWP,i
Data unit:	t CO2/ha
Description:	Carbon stock entering wood products pool at time of deforestation from stratum *i*
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Every $\leq$ 10 years

Value applied:	27.7
Monitoring equipment:	N/A
QA/QC procedures to be applied:	N/A
Purpose of data	Calculation of baseline emissions Calculation of project emissions Calculation of leakage
Calculation method:	Uses Equation 2 in the CP-W module
Comments	None

Data Unit / Parameter:	NewRi,t
Data unit:	ha
Description:	New calculated forest clearance in stratum i at time t by the baseline agent of the planned deforestation where no leakage is occurring
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Every $\leq$ 10 years
Value applied:	<table><tr><th>Year</th><th>NewRi,t</th></tr><tr><td>2013</td><td>0</td></tr><tr><td>2014</td><td>0</td></tr><tr><td>2015</td><td>0</td></tr><tr><td>2016</td><td>0</td></tr><tr><td>2017</td><td>0</td></tr><tr><td>2018</td><td>23</td></tr><tr><td>2019</td><td>23</td></tr><tr><td>2020</td><td>23</td></tr><tr><td>2021</td><td>23</td></tr><tr><td>2022</td><td>23</td></tr></table>
Monitoring equipment:	N/A
QA/QC procedures to be applied:	N/A
Purpose of data	Calculation of leakage
Calculation method:	Uses Equation 4 in the LK-ASP module
Comments	None

Data Unit / Parameter:	PMPi
Data unit:	%
Description:	Merchantable biomass as a proportion of total aboveground tree biomass for stratum i within the project boundaries
Source of data:	Within each stratum divide the summed merchantable biomass (defined as “Total gross biomass (including bark) of a tree 40 cm DBH or larger from a 30 cm stump to a minimum 10 cm top DOB of the central stem”) by the summed total aboveground tree biomass Merchantable biomass is equal to merchantable volume multiplied by wood density (Dmn)
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Must be monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
Value applied:	11.9
Monitoring equipment:	N/A
QA/QC procedures to be applied:	N/A
Purpose of data	Calculation of leakage
Calculation method:	N/A
Comments	None

4.3 Monitoring Plan

This monitoring plan has been developed in close conjunction with module VMD0015 of the REDD Methodological Module, “Methods for monitoring of greenhouse gas emissions and removals (M-MON).” This section focuses on establishing procedures for monitoring deforestation, illegal degradation, natural disturbance, and project emissions ex-post in the project area and leakage areas. Further, procedures for updating the forest carbon stocks and revising the baseline are also provided below.

For accounting purposes, the project conservatively assumes stable stocks and no biomass monitoring is conducted in areas undergoing carbon stock enhancement, as permitted in the methodology monitoring module VMD0015, hence $\Delta C_{P,Enh,i,t}$ is set to 0.

Further as no commercial harvest of timber (including FSC selective logging) occurs in the with project case, the degradation due to harvest of timber will not be monitored, thus parameter $\Delta C_{P,SelLog,i,t}$ is set to 0.

A separate section on quality assurance/quality control and data archiving procedures covers all monitoring tasks.

Organizations responsible for monitoring are listed below in Table 4.8. These organizations are responsible for implementing all aspects of a particular monitoring task, as described in the monitoring sub-sections below.

Estimation of Ex-Post Net Carbon Stock Changes and Greenhouse Gas Emissions

Ex-post net carbon stock changes and greenhouse gas emissions can only be calculated after monitoring:

- The net carbon stock change as a result of deforestation in the project area;
- The net carbon stock change as a result of degradation in the project area;
- The net carbon stock change as a result of natural disturbance in the project area; and
- The greenhouse gas emissions as a result of deforestation and degradation activities within the project area.

Monitoring Deforestation and Natural Disturbance

Forest cover change due to deforestation and natural disturbance is monitored through periodic assessment of classified satellite imagery, see below, covering the project area. Emissions ($\Delta C_{P,Def,i,t}$ and $\Delta C_{P,DistPA,i,t}$ for deforestation and natural disturbance, respectively) are estimated by the multiplying areas $A_{DefPA,u,i,t}$ and $A_{DistPA,q,i,t}$,, for deforestation and natural disturbance, respectively, by average forest carbon stock per unit area. Note that $A_{DistPA,q,i,t}$,, is limited to the area where credits have been issued and is identified as the overlap between the delineated area of the disturbance and the summed area of deforestation in the project area to the year in which the disturbance occurred. Stock estimates from the initial field inventory completed in 2014, are valid for 10 years (per VM0007). Table 4.1 shows the data and parameters monitored.

Table 4.1 Data and Parameters for Monitoring Deforestation and Natural Disturbance.

Parameter	Description	Units	Source/ Justification of Choice of Data or Description of Measurement Methods
$\Delta C_{P,Def,i,t}$	Net carbon stock change as a result of deforestation in the project case in the project area in stratum i at time t	t CO_2e	Calculated
$\Delta C_{P,DistPA,i,t}$	Net carbon stock change as a result of natural disturbance in the project case in the project area in stratum i at time t	t CO_2e	Calculated
$A_{DefPA,u,i,t}$	Area of recorded deforestation in the project area stratum i converted to land use u at time t	Ha	Monitored for each verification event

$A_{DistPA,q,i,t}$	Area impacted by natural disturbance in post-natural disturbance stratum q in stratum i, at time t	Ha	Monitored for each verification event
$C_{BSL,i}$	Carbon stock in all pools in the baseline case in stratum i	t CO_2e ha^{-1}	Estimated from the forest carbon inventory

Changes in forest cover ($A_{DefPA,u,i,t}$ and $A_{DistPA,q,i,t}$) will be monitored using data provided by the State of Acre. UCEGEO, the GIS department within the Climate Change Institute, Acre State government, produces an annual dataset on the extent and spatial location of all deforestation within the state using Landsat images. This dataset extends back to 1988. The definition of forest used in the classified dataset is in broad agreement with the Brazilian definition of a forest[50] as set by the Clean Development Mechanism Designated National Authority.

The UCGEO classification methodology includes atmospheric and geometric correction and uses a supervised classification approach. Landsat images with cloud cover covering less than 10% of a scene were downloaded and corrected for any atmospheric problems (using Carlotto HAZE algorithm) and geometric correction (using images Geocover 2000). Georeferencing was conducted with the nearest neighbor method, using a minimum of 20 points, and had an error (RMS) of less than 1 pixel. The image processing phase includes image segmentation (into statistically homogeneous areas) using Landsat bands 3, 4 & 5 (Blue, green and red). Then representative samples (training sites) of Forest, Non-Forest Water, Cloud and Cloud Shadow are selected using expert knowledge that are distributed throughout the image and represent the variability within each class. A supervised classification[51] approach was used with the Support Vector Machine (SVM) classification algorithm. All processing was implemented in ENVI + IDL 4.6 except georeferencing which was carried out using ERDAS IMAGINE 9.

Additional details on pre-processing can be found in the UCEGEO methodology. Deforestation and natural disturbance will be distinguished using ancillary data which may include but is not limited to high resolution imagery, digital elevation models (to identify steep areas prone to landslides), information from local land managers, etc.

In the case, where this dataset ceases to be available, ex-post deforestation will be determined by classification of remotely sensed imagery and land use change detection procedures.

The project area as set in the PD, will serve as the initial "forest cover benchmark map" against which changes in forest cover will be assessed over the interval of the first monitoring period; the entire project area has been demonstrated to meet the forest definition at the beginning of the crediting period. For subsequent monitoring periods, change in forest cover will be assessed against the preceding classified forest cover map marking the beginning of the monitoring interval. Thus, the forest benchmark map is updated at each monitoring event.

Monitoring Illegal Degradation

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[50] The Clean Development Mechanism Designated National Authority in Brazil has set the forest definition as:
1. Minimum tree crown cover of 30 per cent;
2. Minimum land area of 1 hectare; and
3. Potential to reach a minimum tree height of 5 meters at maturity

See http://cdm.unfccc.int/DNA/ARDNA.html?CID=30, accessed March 5, 2012.

[51] There is no overlap between the accuracy assessment points and the data used for classification.

Emissions due to illegal logging will be tracked by conducting surveys in the surrounding areas every two years. Locations surveyed will include:

- Families residing on the Envira property adjacent to the project area; and
- Nearby ranches and rural properties, along the Jurupari and Envira Rivers.

Surveys will produce information on wood consumers (fuel wood and wood for construction and charcoal production) in the surroundings areas, as well as general indications on the areas where wood is sourced from and maximum depth of penetration of harvest activities from access points. In the event that any potential of illegal logging occurring in the project area is detected from the surveys (i.e. ≥ 10% of those interviewed/surveyed believe that degradation may be occurring within the project boundary), then an estimation of emissions associated with illegal logging will be produced from the survey data and the T-SIG tool applied. The information collected in the PRAs will be used to calculate logging emissions in conjunction with conservative assumptions/estimates including that all wood collected was live, use of a regional charcoal recovery rate, use of a logging damage factor from the methodology, and that trees harvested were in the 99th percentile in terms of dbh.

In the event that the initial assessment indicated that illegal logging is occurring and significant in the area; the potential degradation area within the project area ($A_{DegW,i}$) will be delineated based on survey results, incorporating general area information and depth of penetration. Degradation monitoring plots will be allocated to achieve a 3% sample of this area. Rectangular plots 10 meters by 1 kilometer (1 ha area) will be randomly or systematically allocated in the area, sufficient to produce a 3% sample of the area, and any recently-cut stumps or other indications of illegal harvest will be noted and recorded. Diameter at breast height, or diameter at height of cut, whichever is lower, of cut stumps will be measured. Biomass will be estimated from measured diameters (conservatively assuming that diameters of stumps cut below breast height are equivalent to diameter at breast height) applying the allometric equations of Brown (1997) and otherwise maintain consistency with analytical procedures applied in the original forest inventory report. Emissions due to illegal logging ($\Delta C_{P,DegW,i,t}$) are estimated by multiplying area ($A_{DegW,i}$) by average biomass carbon of trees cut and removed per unit area ($C_{DegW,i,t} / AP_i$).

The 3% sample will be carried out once every 5 years where initial surveys continue to indicate possibility of illegal logging in the project area to produce an estimate of emissions resulting from illegal logging ($\Delta C_{P,DegW,i}$). Estimates of emissions will be annualized (to produce estimates in t CO_2e per year) by dividing the emission for the monitoring interval by the number of years in the interval.

Table 4.2 Data and Parameters for Monitoring Illegal Degradation.

Parameter	Description	Units	Source/ Justification of Choice of Data or Description of Measurement Methods

$A_{DegW,i,t}$	Area potentially impacted by degradation processes in stratum i	Ha	Delineated based on survey results indicating general area of project potentially accessed and typical depth of penetration of illegal harvest activities from points of access
$C_{DegW,i,t}$	Biomass carbon of trees cut and removed through degradation process from plots measured in stratum i at time t	t CO_2e	Estimated from diameter measurements of cut stumps in sample plots
AP_i	Total area of degradation sample plots in stratum i	Ha	Calculated as 3% of $A_{DegW,i,t}$
$\Delta C_{P,DegW,i,t}$	Net carbon stock changes as a result of degradation in stratum i in the project area at time t	t CO_2e	Calculated

Monitoring Project Emissions

With project emissions are calculated as the sum of emission from fossil fuel combustion (EFC,i,t) + non-CO_2 emissions due to biomass burning (EBiomassBurn,i,t) + direct N_2O emissions as a result of nitrogen application (N2Odirect-N,i,t.). As stipulated in the methodology, fossil fuel combustion in all situations is an optional emission source. Further, no nitrogen is applied on pasture land in the with project case and hence project emissions therefore equal EBiomassBurn and are calculated using the VMD0013, “Estimation of greenhouse gas emissions from biomass burning (E-BB)” of the AD Partners modular REDD Methodology.

Non CO_2 emissions from biomass burning in the project case include emissions from burning associated with deforestation and burning associate with natural disturbance, i.e. forest fire. It will be conservatively assumed that the total area burnt during the deforestation process is equal to the area deforested, ADefPA,u,i,t. Thus, the area used when calculating E-BB is equal to Aburn,i,t. (area burnt) = Aburn,q,i,t. (area burnt in natural disturbance) + ADefPA,u,i,t (area burnt via deforestation in project ex post)."

Also, it is conservatively assumed that burning is a part of the forest conversion process in all incidents of deforestation taking place in the activity shifting leakage areas. Thus, the parameter $A_{burn,i,t}$ (Area burnt for stratum *i* at time *t*; ha) will be set equal to monitored parameter $A_{DefLK,i,t}$ (Area of recorded deforestation in the activity shifting leakage areas at time t; ha). The T-SIG tool can then be applied, and if parameter $E_{BiomassBurn,t}$ (Greenhouse emissions due to biomass burning as part of deforestation activities in stratum *i* in year *t*) is determined to be insignificant, $E_{BiomassBurn,t}$, can be assumed equal to zero.

Table 4.3 Data and Parameters for Monitoring Emissions from Biomass Burning.

Parameter	**Description**	**Units**	**Source/ Justification of Choice of Data or Description of Measurement Methods**

E BiomassBurn,t	Greenhouse emissions due to biomass burning as part of deforestation activities in stratum i in year t	tCO_2e of each GHG (CH_4, N_2O)	Calculated
Aburn,i,t	Area burnt for stratum i at time t	Ha	Monitored for each verification event
Bi,t	Average aboveground biomass stock before burning stratum i, time t	tonnes d. m. ha-1	Conservatively assumed to be the carbon stock in all pools in the baseline case (CBSL,i).
COMF i	Combustion factor for stratum i; dimensionless	dimensionless	0.45 for primary open tropical forest. Derived from Table 2.6 of IPCC, 2006.
Gg,i	Emission factor for stratum i for gas g	kg t-1 dry matter burnt	GCH_4 = 6.8 g kg-1 and GN_2O = 0.2 g kg-1. Derived from Table 2.5 of IPCC, 2006.
GWPg	Global warming potential for gas g	t CO_2/t gas g	Default values from IPCC SAR: CH_4 = 21; N_2O = 310).

Monitoring of Leakage Carbon Stock Changes and Greenhouse Gas Emissions

Two sources of leakage will be monitored: activity-shifting leakage and market leakage.

Activity-Shifting Leakage

Activity-shifting leakage will be monitored by tracking areas of deforestation ($A_{defLK,i,t}$), across all lands outside of the project area owned or under management by the baseline agent, JR Agropecuária e Empreendimentos EIRELI, including properties listed in Table 4.4. This will be accomplished by examining remote sensing data, and/or legal records and/or survey information.

The baseline agents of deforestation will be surveyed for each verification event. Further, this information will be checked against remote sensing/aerial imagery where available, including but not limited to: the most recent Acre deforestation dataset, Google Earth, or other. In the event that deforestation is noted, further confirmation will be made that the deforestation resulted from authorized deforestation activities by JR Agropecuária e Empreendimentos EIRELI.

Table 4.4. List of properties in Brazil owned by the JR Agropecuária e Empreendimentos EIRELI.

Number	Property	Land Owner/Manager	State
1	Propriedade Envira	Duarte Jose do Couto Neto	Acre
2	Fazenda Pelicano	Rubens Vasques	Mato Grosso
3	Fazenda Esperanca	Bento Ferraz Pacheco	Mato Grosso
4	Seringal Canada	Duarte Jose do Couto Neto	Acre
5	Seringal Bom Principio	Duarte Jose do Couto Neto	Acre

6	Seringal Agrilo do Norte	Duarte Jose do Couto Neto	Acre
7	Seringal Porto Envira	Duarte Jose do Couto Neto	Acre
8	Seringal Nazareth	Duarte Jose do Couto Neto	Acre
9	Seringal Liberdade Parte A	Duarte Jose do Couto Neto	Acre
10	Seringal Ceci	Duarte Jose do Couto Neto	Acre
11	Gleba Canada II	Duarte Jose do Couto Neto	Acre

Market Leakage

Market leakage values calculated ex-ante are also used ex-post as no with project harvesting of timber, fuel wood or charcoal is destined for commercial markets. Please see Table 3.32 for market leakage estimates.

Table 4.5 Data and Parameters for Leakage.

Parameter	Description	Units	Source/ Justification of Choice of Data or Description of Measurement Methods
ADefLK,i,t	The total area of deforestation by the baseline agent of the planned deforestation in stratum I at time, t	ha	Monitored for each verification event

Monitoring of Actual Carbon Stock Changes and Greenhouse Gas Emissions

Forest carbon stock estimates will be derived from field measurements less than or equal to 10 years old. Aboveground and belowground live tree and dead wood stocks will be re-assessed on or before 2023. For each stratum, where the re-measured estimate is within the 90% confidence interval of the t=0 estimate, the t=0 stock estimate takes precedence and is re-employed, and where the re-measured estimate is outside (i.e. greater than or less than) the 90% confidence interval of the t=0 estimate, the new stock estimate takes precedence and is used for the subsequent period.

Sample plots will be randomly located in areas within the Envira Amazonia Project and measured following standard operating procedures located in Appendix B. Biomass will be estimated applying the following allometric equations and otherwise maintain consistency with analytical procedures applied in the original inventory ("Forest biomass carbon inventory for the Envira Project, Acre State, Brazil," 2014). For live trees, biomass is calculated as a function of diameter at breast height (DBH; in cm) using the predictive model developed by Brown[52] for tropical moist forest stands. Application of the "moist" equation reflects the annual precipitation for the inventoried area, 2200mm.

aboveground biomass (kg) = ((42.69-12.8*(DBH)+1.242*(DBH)^2)) Equation 4.1

[52]Brown, S., 1997. Estimating biomass and biomass change of tropical forests: A primer. FAO Forestry Paper: vii, 55 p.

For palms, height and basal diameter measurements are used to estimate the aboveground volume of a paraboloid and then mean (species level) Amazonian palm specific gravity of 0.31 g/cm3 estimated by Baker et al (2004) will be applied. The estimate of biomass for palms is therefore to be limited to the main trunk (bole) of the palm. Thus, for palms

aboveground biomass (Mg) = 0.5*Π*(basal diameter(cm)/200)^2*height(m)*0.31 Equation 4.2

Root biomass density is estimated at the cluster sample level applying the equation developed by Cairns et al.[53] , where

Root Biomass Density (t/ha) = EXP (-1.085 + 0.925 LN(aboveground biomass density)) Equation 4.3

The volume of lying dead wood per unit area is estimated using the equation (Warren and Olsen[54]) as modified by Van Wagner[55] separately for each dead wood density class:

$$\boxed{V_{LDW} = \frac{\pi^2 * \left(\sum_{n=1}^{N} D_n^{\ 2}\right)}{8 * L}} \qquad \text{Equation 4.4}$$

where:

V_{LDW} Volume of lying dead wood per unit area; m^3 ha^{-1}

D_n Diameter of piece n of dead wood along the transect; cm

N Total number of wood pieces intersecting the transect; dimensionless

L Length of the transect; m

Length of each transect was corrected for slope. The volumes per unit area of each dead wood density class are then multiplied by their respective densities to convert to a mass per unit area.

Biomass of standing dead wood is estimated using the allometric equation for live trees in the decomposition class 1. In decomposition class 2, the estimate of biomass was limited to the main trunk (bole) of the tree, in which case the biomass was calculated converting volume to biomass using dead wood density classes. Volume was estimated as the volume of a cone, as specified in the VM0007 module, "Estimation of carbon stocks in the dead wood pool".

[53] Cairns, M. A., S. Brown, E. H. Helmer, and G. A. Baumgardner. 1997. Root biomass allocation in the world's upland forests. Oecologia 111, 1-11.
[54] Warren, W.G. and Olsen, P.F. (1964) A line intersect technique for assessing logging waste. Forest Science 10: 267-276.
[55] Van Wagner, C.E. (1968). The line intersect method in forest fuel sampling. Forest Science 14: 20-26.

Density of dead wood is determined through sampling and laboratory analysis. Discs are collected in the field and decomposition class and green volume determined as per standard protocols (see Appendix B for more details). The resulting dry weight is recorded and used to calculate dead wood density as oven-dry weight (g) / green volume (cm^3) for each sample.

Dry mass is converted to carbon using the default carbon fraction of 0.47 t C/t d.m. (as recommended by IPCC[56] Guidelines for National Greenhouse Gas Inventories).

Table 4.6 Data and Parameters for Monitoring Carbon Stocks Changes and GHG Emissions.

Parameter	Description	Units	Source/ Justification of Choice of Data or Description of Measurement Methods
CWP100,i	Carbon stock entering the wood products pool at the time of deforestation that is expected to be emitted over 100-years from stratum i	t CO2-e ha-1	Calculated
ΔCAB_tree,i	Baseline carbon stock change in aboveground tree biomass in stratum i	t CO2-e ha-1	Estimated from the forest carbon inventory
ΔCBB_tree,i	Baseline carbon stock change in belowground tree biomass in stratum i	t CO2-e ha-1	Estimated from the forest carbon inventory
ΔCDW,i	Baseline carbon stock change in dead wood in stratum i	t CO2-e ha-1	Estimated from the forest carbon inventory

Revision of the Baseline

The baseline will be revised every 10 years from the project start date. As the entire project area will have been deforested during the initial baseline period, no new areas will be deforested post 2022 in the baseline. From 2023 onward, the baseline is therefore limited to delayed emissions in the dead wood, below ground biomass, and wood product pools resulting from deforestation in the initial baseline period. Should an analysis of proxy areas be warranted to estimate a rate of deforestation, the BL-PL module will be consulted.Data collection procedures in regards to revision of the baseline will include participatory rural appraisals, interviews and collaboration with the Acre State government, UCEGEO, the GIS department within the Climate Change Institute, and municipal officials. In the case, where the Acre State government no longer produces the annual dataset on the extent and spatial location of all deforestation within the state, deforestation maps will be prepared by classifying remotely sensed imagery. Other

[56] IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Chapter 4 AFOLU (Agriculture, Forestry and Other Land-use).

datasets used to substantiate aspects of the baseline with be from official government sources, peer reviewed publications, or other reputable sources.

Table 4.7 Data and Parameters for Revising the Baseline.

Parameter	Description	Units	Source/ Justification of Choice of Data or Description of Measurement Methods
ΔCBSL,planned	Net greenhouse gas emissions in the baseline from planned deforestation	t CO_2e	Calculated every 10 years
ΔCBSL,i,t	Net carbon stock changes in all pools in the baseline stratum i at time t	t CO2-e	Calculated every 10 years
GHGBSL-E,i,t	Greenhouse gas emissions as a result of deforestation activities within the project boundary in the baseline stratum i during project year t	t CO2-e year-1	Calculated every 10 years
AAplanned,i,t,	Annual area of baseline planned deforestation for stratum i at time t	ha	Calculated every 10 years
ΔCstocks,i	Baseline carbon stock change in stocks in stratum i	t CO2-e ha-1	Estimated from the forest carbon inventory. See Table 4.6.

Quality Assurance/Quality Control and Data Archiving Procedures

Monitoring Deforestation, Natural Disturbance, and Leakage

To ensure consistency and quality results, spatial analysts carrying out the imagery processing, interpretation, and change detection procedures will strictly adhere to best practices and good practice guidelines, when using the alternative method for quantifying deforestation. All data sources and analytical procedures will be documented and archived (detailed under data archiving below).

Data provided by UCEGEO has undergone geometric correction, extensive processing, and accuracy evaluation as mentioned by the State of Acre (2011) in their "Review of deforestation dynamics of deforestation in Acre"[57]. Accuracy of the classification, for both the baseline and monitoring, will be assessed by comparing the classification with ground-truth points or samples of high resolution imagery. Any data collected from ground-truth points will be recorded (including GPS coordinates, identified land-use class, and supporting photographic evidence) and archived. Any sample points of high resolution imagery used to assess classification accuracy will also be archived. Samples used to assess classification accuracy should be well-distributed throughout the project area (as far as is possible

[57] ACRE - Governo do Estado do Acre. REVISÃO DA DINÂMICA DO DESMATAMENTO NO ESTADO DO ACRE: ANÁLISE TEMPORAL DE 23 ANOS (PERÍODO DE 1988 A 2010). Rio Branco: (UCEGEO - FUNTAC/SEMA), 2011.

considering availability of high resolution imagery and/or logistics of acquiring ground-truth data), with a minimum sampling intensity of 50 points each for the forest and non-forest classes.

The classification will only be used in the forest cover change detection step if the overall classification accuracy, calculated as the total number of correct samples / the total number of samples, is equal to or exceeds 90%.

All data sources and processing, classification and change detection procedures will be documented and stored in a dedicated long-term electronic archive.

Information related to monitoring deforestation maintained in the archive will include:

- Forest / non-forest maps;
- Documentation of software type and procedures applied (including all pre-processing steps and corrections, spectral bands used in final classifications, and classification methodologies and algorithms applied), if applicable; and
- Data used in accuracy assessment - ground-truth points (including GPS coordinates, identified land-use class, and supporting photographic evidence) and/or sample points of high resolution imagery.

Forest Carbon Stocks and Degradation

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

1. Trained field crews will carry out all field data collection and adhere to standard operating procedures. Pilot sample plots shall be measured before the initiation of formal measurements to appraise field crews and identify and correct any errors in field measurements. Field crew leaders will be responsible for ensuring that field protocols are followed to ensure accurate and consistent measurements. To ensure accurate measurements, the height of diameter at breast height (1.3 m) will be periodically re-assessed by personnel during the course of the inventory.
2. Field measurement data will be recorded on standard field data sheets and entered into an excel database for data management and quality control. Potential errors in data entry (anomalous values) will be verified or corrected consulting the original data sheets or personnel involved in measurement. Original data sheets will be permanently archived in a dedicated long-term electronic archive. The electronic database will also archive GIS coverages detailing forest and strata boundaries and plot locations.

Quality control procedures for sampling degradation will include steps 1 and step 3, above.

Quality control procedures related to monitoring leakage include conducting baseline agent surveys and reviewing records documenting deforestation by the agent of deforestation and checking these figures against remotely sensed imagery where available.

Personnel involved in the revising of the baseline will have detailed knowledge in regards to spatial modeling and land use change and deep familiarity with REDD methodologies. Remote sensing data used will include officially published dataset, or classified imagery, which meets accuracy assessment requirements as laid out in the methodology.

All measurement and monitoring equipment requiring calibration will be calibrated according to the equipment's specifications and/or relevant national or international standards.

Data Archiving

Data archived will be maintained through at least two years beyond the end of the project crediting period. All project records are secure and retrievable. This includes project documents saved on the desktop of CarbonCo's Project Director and stored in the Director's file cabinets (based in Silver Spring, Maryland). An identical version of the project documents are remotely saved on an external hard drive and in the cloud via DropBox. Furthermore, many project documents (e.g., VCS Project Description, Monitoring Reports, CCBS Project Design Document, Project Implementation Reports, Validation and Verification Reports, etc.) are publicly available and stored on both the Standards' website and on the Markit Environmental Registry. Given the extended time frame and the pace of production of updated versions of software and new hardware for storing data, electronic files will be updated periodically or converted to a format accessible to future software applications, as needed.

Organization, Responsibilities, and Monitoring Frequency

For all aspects of project monitoring, Envira Amazonia Project staff will ensure that data collection, processing, analysis, management and archiving are conducted in accordance with the monitoring plan.

Table 4.8. Type of Monitoring and Party Responsible for Monitoring.

Variables to be monitored	**Responsible**	**Frequency**
Monitoring deforestation and natural disturbance	JR Agropecuária e Empreendimentos EIRELI	Prior to each verification
Monitoring illegal degradation	JR Agropecuária e Empreendimentos EIRELI	Every two years
Monitoring project emissions	CarbonCo	Prior to each verification
Activity shifting leakage assessment	JR Agropecuária e Empreendimentos EIRELI	Prior to each verification
Updating forest carbon stocks estimates	CarbonCo	At least every 10 years.
Revision of the baseline	CarbonCo	At least every 10 years.

5 ENVIRONMENTAL IMPACT

Deforestation and its associated GHG emissions, is a global environmental issue but its effects locally and regionally are particularly concerning in developing countries where economies and livelihoods are more closely linked to farming and utilization of natural resources. The Envira Amazonia Project will result in positive environmental benefits by conserving forest land leading to less environmental degradation than would have occurred when lands are converted to pasture or cropland. The conservation of the Amazon Rainforests is vitally important to humankind and the global environment, as well as the local environment, as these forests provide a wide range of critical ecosystem services including their ability to:

- Improve local air and water quality by filtering pollutants;
- Help regulate water and nutrient cycles (e.g., phosphorous and nitrogen);
- Control flooding by minimizing runoff and soil loss;
- Provide habitat for biodiversity and nutrition for wildlife;
- Provide aesthetical, spiritual and cultural benefits to local communities;
- Produce oxygen - without which life would not be possible; and
- Absorb carbon dioxide, a greenhouse gas, to mitigate climate change.

As a conservation project, the Envira Amazonia Project will ultimately have a net positive environmental impact. More specifically, the Project will benefit the local communities and region overall by improved water quality and securing land for natural flood storage (i.e., lessening the effect of floods). Further, with conservation as a focal point, the Envira Amazonia Project will maintain critical habitat for wildlife, including threatened and endangered species.

The International Union for Conservation of Nature (IUCN) has identified 26 species in Acre as Near Threatened, Vulnerable, Endangered, Critically Endangered and Extinct.[58] At the Envira Amazonia Project, a total of 376 individuals were found amongst the following four vulnerable species (Figure 5.1).

Table 5.1. Species identified in the Envira Amazonia Project Area on the IUCN Red List.

Kingdom	Genus	Species	Common Names (English)	Nome Vernacular (Common Portuguese Name)	Red List Status	Number of Individuals Identified
Plantae	Amburana	acreana	N/A	Cerejeira	Vulnerable	15
Plantae	Cedrela	odorata	Spanish Cedar, Cigar-box wood, Red Cedar	Cedro rosa	Vulnerable	39
Plantae	Rinorea	longistipulata**	N/A	Canela de Velho	Vulnerable	297
Plantae	Swietenia	macrophylla	Big Leaf Mahogany, Brazilian	Mogno	Vulnerable	25

[58] IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2. <www.iucnredlist.org>. Downloaded on 01 February 2012.

			Mahogany, Large-leaved Mahogany			

**Rinorea longistipulata and Rinorea viridifolia are generally distinguished due to their growth form, where R. longistipulata is a larger tree and R. viridifolia is a small tree/ shrub. This growth form distinction makes identification of small R. longistipulata near impossible in the field.

Figure 5.1a-d. Photographs of listed species *(Photo Credit: TECMAN)*.

The Southwestern Amazon is also home to many endemic species. According to the Integrated Biodiversity Assessment Tool[59], the region where the Envira Amazonia Project is located has also been identified as a Key Biodiversity Area. For more details, please see the CCBS project document.

[59] www.ibatforbusiness.org

6 STAKEHOLDER COMMENTS

The following stakeholders were involved in project design to optimize climate, community and biodiversity benefits while ensuring the Envira Amazonia Project was best aligned with the State of Acre's climate mitigation, community, and biodiversity goals.

- JR Agropecuária e Empreendimentos EIRELI
- Families living within the Envira Amazonia Project Zone
- Carbonfund.org Foundation, Inc. and CarbonCo, LLC
- Freitas Group International LLC and Carbon Securities
- TerraCarbon, LLC
- TECMAN LTDA
- Professor Antonio Willian Flores de Melo of UFAC
- Ayri Saraiva Rando
- Landowners and families living around the Envira Amazonia Project
- State of Acre, particularly the Climate Change Institute of Acre (IMC)
- State of California, including the California Air Resources Board (ARB) and REDD Offset Working Group (ROW), along with the Governors' Climate and Forest Task Force

A summary of project meetings and stakeholder comments have been provided below. Further information on meetings can be found in the document "Envira Amazonia Project Meeting Notes" as found in the project database.

March 9-18, 2011 - CarbonCo, Carbon Securities and TerraCarbon traveled to Acre, Brazil to better understand how to implement REDD+ projects in Acre, Brazil. A few key milestones included:

- CarbonCo, Carbon Securities and TerraCarbon held initial meetings with PESACRE (Grupo de Pesquisa e Extensão em Sistemas Agroflorestais do Acre), IPAM (Instituto de Pesquisa Ambiental da Amazônia), FUNTAC (Fundacao de Tecnologia do Estado do Acre), and SISA (System of Incentives for Environmental Services) to gain an understanding of the agents and drivers of deforestation in Acre state, how forest biomass stocks vary across the state, and local REDD+ and forest conservation initiatives;
- Carbon Securities and TerraCarbon met with Acre State Officials, including Monica Julissa De Los Rios de Leal and Eufran Amaral, on Friday, March 18th.
- The Purus Project's design, which would later influence how the Envira Amazonia Project was designed, was revised based off this initial site visit in March 2011. For example, the Project Proponents: began to design the Project around the identified drivers and agents of deforestation (i.e., selection of appropriate VCS methodology); chose the source of satellite imagery (i.e., FUNTAC/Climate Change Institute); and began a close, consultative relationship with the State of Acre.

August 9-18, 2011 - CarbonCo, Carbon Securities, and TerraCarbon visited Rio Branco. A few key milestones included:

- TerraCarbon led a classroom forest carbon inventory training for TECMAN field crew for the Purus Project. TECMAN would later be hired for the Envira Amazonia Project.
- CarbonCo, Carbon Securities, TerraCarbon, and TECMAN met with Acre State officials, including Monica Julissa De Los Rios de Leal and Lucio Flavio, to discuss how to best design the forest carbon inventory to align with the State of Acre's goals and future forest inventory plans. The Project's forest carbon inventory design (for example, the size of each plot and the plot design) was revised based off the State of Acre and TECMAN's input;
- CarbonCo, Carbon Securities, and TerraCarbon visited the Purus Project to train TECMAN's field crew in forest inventory practices and standard operating procedures, which would later be used during the Envira Amazonia Project's forest carbon inventory.
- CarbonCo, Carbon Securities, and TerraCarbon met with Willian Flores to discuss the VCS methodology, VM0007 REDD Methodology Modules, applicable to modeling regional deforestation. Willian Flores would later be used for the Envira Amazonia Project.
- CarbonCo, Carbon Securities, TerraCarbon, and Willian Flores met with Acre State officials, including Monica Julissa De Los Rios de Leal, Eufran Amaral and Lucio Flavio on Tuesday, August 9th to discuss how to best develop the project-level baseline; how private projects will nest with a forthcoming state-level baseline; and the type of GIS data available from the State of Acre.

November 21, 2011 – CarbonCo spoke with Shaina Brown, Project Director at the Green Technology Leadership Group and Tony Brunello, the REDD Offset Working (ROW) Group's facilitator to better understand the developments in the State of California and how they relate to the State of Acre.

February 10, 2012 – CarbonCo spoke with Natalie Unterstell, the focal point for REDD+ at Brazil's Federal Ministry of Environment. Discussions were based around:

- The role of Brazil's Federal Government in the REDD+ context; Progress of the Amazon Fund; How States, particularly Acre, might nest into National Government; How Brazil's domestic cap-and-trade market is shaping up; Market mechanisms and REDD+ as potentially eligible offsets; Where to go for REDD+ information on Federal government updates and how to inform Government of our Project.

August 2, 2012 – CarbonCo, Carbon Securities and JR Agropecuária e Empreendimentos EIRELI signed Tri-Party Agreement

April 5, 2013 - CarbonCo, Carbon Securities, and Ilderlei Souza Rodrigues Cordeiro (owner of Russas Project) met again with Eufran Amaral from the Climate Change Institute to give an update on all the Projects, including informing about moving forward with the Envira Amazonia Project, and received updates on the work of the Climate Change Institute.

April 30, 2013 – CarbonCo held another call with Natalie Unterstell of Brazil's Ministry of Environment to update her that the Purus Project became the first dual VCS-CCBS validated REDD+

Project in Acre and that the Envira Amazonia Project would undergo VCS-CCBS validation later in 2014.

May 7-9, 2014 – CarbonCo, Carbon Securities and TerraCarbon met JR Agropecuária e Empreendimentos EIRELI (particularly Duarte Jose do Couto Neto, Fredis C. Vasques and Jose Elves Araruna Sousa) to discuss the VCS Project Description and CCBS Project Design Document. The conversations focused on identifying proxy sites and further refining the proposed project activities.

May 8, 2014 – CarbonCo, Carbon Securities and TerraCarbon met with the Climate Change Institute to give an update on all Acre REDD+ projects, including the Envira Amazonia Project, and received updates on the latest developments at the Climate Change Institute. More specifically, this meeting was with Monica Julissa De Los Rios de Leal and Magaly Medeiros, the new director of the Climate Change Institute.

May 9, 2014 – CarbonCo, Carbon Securities, JR Agropecuária e Empreendimentos EIRELI (particularly Fredis C. Vasques) and TerraCarbon met TECMAN for a classroom training refresher on the Envira Amazonia Project's forest carbon inventory and standard operating procedures.

May 10, 2014 - CarbonCo, Carbon Securities, JR Agropecuária e Empreendimentos EIRELI (particularly Fredis C. Vasques) and TerraCarbon met TECMAN in the field to further refine field techniques for the Envira Amazonia Project's forest carbon inventory and further review standard operating procedures**.**

May 13, 2014 – CarbonCo and Carbon Securities met Ayri Saraiva Rando to review community surveys and discuss logistics to visit Envira Amazonia Project.

May 13, 2014 – CarbonCo and Carbon Securities met Fronika de Wit to introduce the Project Proponents, gave an overview of all Acre REDD+ projects underway (particularly the Envira Amazonia Project), and discussed how Fronika de Wit might be able to participate in the Project.

May 19, 2014 – Carbon Securities met with Rodrigo Fernandes das Neves, the State Prosecutor, to discuss the Acre REDD+ Projects including the Envira Amazonia Project, and to get an update on the state-level baseline.

May 20-21, 2014 – CarbonCo, Carbon Securities, and JR Agropecuária e Empreendimentos EIRELI met Maron Greenleaf to introduce the Project Proponents, give an overview of all Acre REDD+ projects underway (particularly the Envira Amazonia Project), and discussed Maron Greenleaf's anthropological research in Acre for her PhD at Stanford University.

May 20 – June 11, 2014 – Ayri Rando met with a total of 10 families in the Project Zone and 31 families along the Envira River (i.e., outside the Project Zone) to: explain what is REDD+, explain the landowners' proposed activities and explain the overall Project design; discuss the benefits of the Project and listen to the concerns of the local families and listen to the families' anticipated results; inform the families about another visit in October or November to notify them about the CCBS Public Comment Period and another visit in December with an independent auditor; and to conduct research on basic necessities, agricultural needs, and participatory rural appraisals. The Project was significantly revised based off the families' input. For example, the Project was revised by incorporating specific agricultural extension courses, restructuring the Project's implementation schedule, and targeting the needs of women.

August 10-31, 2014: CarbonCo and Carbon Securities contacted several potential contractors to assist the Project Proponents in 2015 with a rapid assessment of endemic and vulnerable bird species throughout the Project Zone. This includes Brazilian biologists Guilherme Serpa, Luiz Henrique Medeiros Borges, Fernando Pacheco, and Tomaz Nascimento de Melo.

Mechanisms for Ongoing Communication

CarbonCo, Carbon Securities, and JR Agropecuária e Empreendimentos EIRELI are committed to meet in person at least once per year to discuss project activities and project management. The Project Proponents and/or their representatives shall regularly meet with the local community to get their feedback, ideas, and provide a platform for discussion.

APPENDICES

APPENDIX A. VCS NON-PERMANENCE RISK REPORT

A1.0 INTRODUCTION

The risk analysis has been conducted in accordance with the VCS AFOLU Non-Permanence Risk Tool, dated 04 October 2012, version 3.2. This tool assesses a project's internal risk, external risk, natural risk and mitigation measures which help to reduce risk. The risk ratings and supporting evidence are detailed in Section A1.1, A1.2, and A1.3, below. Letters in the risk factor column correspond to the risk factor explained in the VCS AFOLU Non-Permanence Risk Tool.

A1.1 INTERNAL RISKS

Project Management		
Risk Factor	Risk Factor and/or Mitigation Description	Risk Rating
a)	Not applicable. Tree planting is not a project activity for which GHG credits will be issued.	0
b)	Ongoing enforcement is required to prevent encroachment by outside actors. The Envira Amazonia Project employs forest patrols to prevent encroachment by outside actors into the project area.	2
c)	Management team does include individuals with significant experience in all skills necessary to successfully undertake all project activities.	0
d)	Local management partners are based in Rio Branco less than a day's travel from the project activity. There is a project manager living on the property and a project headquarters is being established on the property.	0
e)	Project proponents have developed other forest carbon projects and have been working in the forest carbon arena for over 5 years. Brian McFarland of CarbonCo has developed the Russas, Valparaiso and Purus Projects under the VCS and the CCBS including managing the project design, implementation, and financing. The project proponents work alongside and have access to experts in carbon accounting and reporting (i.e., TerraCarbon) who have significant experience in all aspects of AFOLU project design and implementation, carbon accounting and reporting under the VCS Program. TerraCarbon has successfully validated and verified numerous projects under the VCS, including validation and verification of the VCS ARR project "Reforestation Across the Lower Mississippi Valley"	-2
f)	There is no adaptive management plan in place.	0
Total Project Management (PM) [as applicable, (a + b + c + d + e + f)] Total may be less than zero.		**0**

Financial Viability		
Risk Factor	Risk Factor and/or Mitigation Description	Risk Rating

a-d)	Project cash flow breakeven point is 4 years or less from the current risk assessment. Details are provided in a cash flow analysis which can be found in the project database.	0
e-h)	Project has secured 100% of funding needed to cover the total cash out before the project reaches breakeven. Details are provided in a cash flow analysis which can be found in the project database.	0
i)	Project has available at least 50% of the total cash out before project reaches breakeven. Project proponents are utilizing internal, non-restricted funds as evidenced in the project database.	0
Total Financial Viability (FV) [as applicable, ((a, b, c or d) + (e, f, g or h) + i)] Total may not be less than zero.		0

Opportunity Cost		
Risk Factor	Risk Factor and/or Mitigation Description	Risk Rating
a	The highest risk rating has been chosen as the NPV from the most profitable alternative land use activity (pasture) is expected to be at least 100% more than that associated with project activities. An NPV analysis is not required as the chosen risk rating is the highest and most conservative.	8
b-d)	Not applicable.	0
e-f)	Not applicable.	0
g)	None of the project proponents are a non-profit organization.	0
h-i)	There is a legal contractual agreement to maintain the project area as forest for at least a 30 year period (i.e. the length of the crediting period) from the project start date.	-2
Total Opportunity Cost (OC) [as applicable, (a, b, c, d, e or f) + (g or h)] Total may not be less than 0.		**6**

Project Longevity		
a)	Not applicable.	0
b)	There is a legal contractual agreement to maintain the project activities and maintain the project area as forest for at least a 30 year period from the project start date. The landowners of the property are under contractual obligations[60] which limit their development/use of the property, as stated below. "The landowner acknowledges and agrees to not execute any activity that otherwise might interfere with the [project] implementation…including but not limited to, i. Clearing the forest for livestock;	15

[60] See the Tri-Party Agreement located in the project database.

	ii. Clearing the forest for agriculture; iii. Expanding old roads or constructing new ones…; iv. Expansion into new forests on Property for community use or infrastructure facilities (i.e., bridges, housing, electricity, etc.); v. Expanding logging operations; and vi. Deforestation for new mining or mineral extraction.”	
Total Project Longevity (PL) May not be less than zero		15
Total Internal Risks		
Total Internal Risks (PM + FV + OC + PL) Total may not be less than zero.		**21**

A1.2. EXTERNAL RISKS

Land Tenure and Resource Access/Impacts		
Risk Factor	Risk Factor and/or Mitigation Description	Risk Rating
a)	The landowner, who is also a project proponent, owns the project area outright (see Section 1.12) and has full resource access/use rights, which are not shared with anyone. The property was geo-referenced and officially registered in the cadaster (Cadastro Ambiental Rural), a process which involved on the ground assessment of all property boundaries and consultations with neighboring landowners and resolution of any existing boundary disputes.	0
b-d)	Not applicable. Community members that have been living on land adjacent to the project area and who made the land productive (e.g., by growing crops or raising animals) for ten years, have the right to be titled. To resolve ongoing disputes over land, JR Agropecuária e Empreendimentos EIRELI will voluntarily recognize whatever area is currently deforested and under productive use by each family. However these land tenure "disputes" concern deforested areas, rather than the forested Project Area of the Envira Amazonia Project.	0
e)	Not applicable.	0
f)	There is a legal contractual agreement to maintain the project area as forest for at least a 30 year period (i.e. the length of the crediting period) from the project start date.	-2
g)	Not applicable.	0
Total Land Tenure (LT) [as applicable, ((a or b) + c + d + e+ f)] Total may not be less than zero.		0

Community Engagement		
Risk Factor	Risk Factor and/or Mitigation Description	Risk Rating
a)	All households living on the Envira Amazonia property directly adjacent to the project area have been consulted.	0

b)	To their knowledge, the project proponents have contacted all families reliant on the project area.	0
c)	Not applicable.	0
Total Community Engagement (CE) [where applicable, (a+b+c)] Total may be less than zero.		0

Political Risk		
Risk Factor	Risk Factor and/or Mitigation Description	Risk Rating
a-e)	The average governance score for 2008 through 2012 is 0.05, or between the governance score of -0.32 to less than 0.19. Details of the calculation are provided below.	2
f)	Acre, Brazil is participating in the Governors' Climate and Forest Taskforce. Further, Brazil has an established Designated National Authority under the CDM and has at least one registered CDM Afforestation/Reforestation project.[61]	-2
Total Political (PC) [as applicable ((a, b, c, d or e) + f)] Total may not be less than zero.		0

Political risk was evaluated using the latest World Bank index data.
Table A1. Calculation of Brazil's average governance score.

Governance Indicator	**2008**	**2009**	**2010**	**2011**	**2012**
Control of Corruption	-0.02	-0.12	0.00	0.15	-0.07
Government Effectiveness	-0.09	-0.10	-0.04	-0.12	-0.12
Political Stability	-0.29	0.16	0.01	-0.13	0.07
Regulatory Quality	0.07	0.11	0.16	0.18	0.09
Rule of Law	-0.37	-0.22	0.00	-0.01	-0.11
Voice and Accountability	0.51	0.49	0.53	0.47	0.43
Overall Mean					0.05

Total External Risks	
Total External Risks (LT + CE + PC) Total may not be less than zero.	0

[61] Project 2569: Reforestation as Renewable Source of Wood Supplies for Industrial Use in Brazil (http://cdm.unfccc.int/Projects/DB/TUEV-SUED1242052712.92/view).
Project 3887: AES Tietê Afforestation/Reforestation Project in the State of São Paulo, Brazil (http://cdm.unfccc.int/Projects/DB/SGS-UKL1280399804.71/view).

A1.3. NATURAL RISKS

Fire	
Discussion/ Evidence	Most of the project area is un-fragmented forest, with few areas of bordering pasture/non-forest. Most forest fires that occur in the region are anthropogenic, and thus sources of fire outbreaks in the project area are limited. In a study[62] of fires in the Amazon, Cochrane and Laurance documented a relationship between fire incidence and distance from forest edge, with decreasing fire return intervals with increasing distance from edge. They also found that effects of forest fires depend on the extent and condition of fuel sources. In general, drought conditions need to be present prior to the initiation of rainforest fires. While initial fires can have a significant effect on the smaller diameter (<40 cm dbh) trees, it is only with subsequent burns, that significant losses (mortality of up to 40% of trees) of forest biomass can be expected[63]. Despite fire induced tree mortality, tree mortality itself is unlikely to result in the loss of substantial biomass due to incomplete combustion of live aboveground biomass. Biomass is merely transferred from the live biomass to dead biomass pool, which is also accounted for in this project. Further as fire is unlikely to affect the whole project area, the significance of any single fire event is likely to be minor and result in less than 25% loss in carbon stocks in the project area. The Cochrane and Laurance study[64] mentioned above, calculated a fire return intervals in another part of the Amazon as 10 to 15 years. While the agents of deforestation (and fire) are similar between region of the study (Para) and the project region (Acre), deforestation rates and likely incidences of fire are greater in Para. This fire return interval therefore is likely to represent a conservative estimate of the fire return interval in the project region with the actual interval likely being longer than 15 years.
Significance	Minor (5% to less than 25% loss of carbon stocks)
Likelihood	Every 10 to 25 years
Score (LS)	2
Mitigation	None

[62]Cochrane M.A.& Laurance W.F., 2002. Fire as a large-scale edge effect in Amazonian forests, Journal Of Tropical Ecology, 18:311-325.
[63]Cochrane M.A., Alencar A., Schulze M.D., Souza C.M., Nepstad D.C., Lefebvre P. & Davidson E.A., 1999. Positive feedbacks in the fire dynamic of closed canopy tropical forests, Science, 284(5421):1832-1835.
Cochrane M.A.& Schulze M.D., 1999. Fire as a recurrent event in tropical forests of the eastern Amazon: Effects on forest structure, biomass, and species composition, Biotropica, 31(1):2-16.
[64] Cochrane M.A.& Laurance W.F., 2002. Fire as a large-scale edge effect in Amazonian forests, Journal of Tropical Ecology, 18:311-325.

Pest and Disease	
Discussion/ evidence	The forests of the project area have a high diversity of tree species, with over 150 tree species >10 cm dbh[65], and like other diverse tropical forests, are not known to be subject to catastrophic disturbance by insect pests or forest diseases. Forest pests and diseases as a source of risk are more relevant in temperate forests or plantations, with low species diversity and consequently susceptible to extensive damage due to pest and disease outbreaks, which tend to be concentrated on single host species. Further, there is no history of catastrophic forest disturbance due to forest pests or diseases in the region.
Significance	Insignificant
Likelihood	Once every 100 years or more. Risk is not applicable to the project area
Score (LS)	0
Mitigation	None

Extreme Weather	
Discussion/ Evidence	While extreme weather events in the region include drought, flooding, and disturbance by wind, this analysis is limited to disturbance by wind as this is the only disturbance which has a direct effect on carbon stocks. As flooding within the project region is common, high water levels in the forest do not lead to a reduction in the forest carbon stocks. Drought does not have a direct effect on existing forest carbon stocks, but instead can increase the severity of forest fires and hence is covered above in the section on fire risk. In relation to disturbance by wind, the recurrence intervals for large blow down disturbances in the western Amazon have been estimated at 27,000 years.[66]
Significance	Insignificant <5% loss of carbon stocks
Likelihood	Once every 100 years or more.
Score (LS)	0
Mitigation	None

Geologic Risk	
Discussion/ Evidence	Neither volcanoes nor active tectonic fault lines are present within the project area. Landslides are not likely to occur within the project area because the project area is relatively level (less than 5% slope) terrain.
Significance	Minor

[65] For more information see the results of the "Forest biomass carbon inventory for the Envira Project, Acre State, Brazil" in the project database.
[66] Espírito-Santo, F.D.B.; Keller, M.; Braswell, B.; Nelson, B.W.; Frolking, S.; Vicente, G. 2010. Storm intensity and old-growth forest disturbances in the Amazon region. Geophysical Research Letters. 37, L11403, doi:10.1029/2010GL043146.

Likelihood	Once every 100 years or more
Score (LS)	0
Mitigation	None

Natural risk is quantified by assessing both the significance (i.e. the damage that the project would be sustained if the event occurred, expressed as an estimated percentage of average carbon stocks in the project area that would be lost in a single event) and likelihood (i.e., the historical average number of times the event has occurred in the project area over the last 100 years) of the four primary types of natural risk, including the risk of fire, pest and disease, extreme weather, and geologic hazards. The significance of the risk of all natural disturbances has been assessed as “Minor” or “Insignificant” as none of the risks should they occur would lead to a loss of greater than 25% of the carbon stocks in the project area in the case of fire or greater than 5% in the case of pest and disease, extreme weather and geologic risk. The occurrence of any natural risk is unlikely to affect 50% of the project area. Where a natural risk does occur, it is unlikely to remove >50% or the carbon stocks in the project area. While it is possible for trees to be killed due to natural risks such as fire or flooding, the majority of biomass within the live biomass carbon pool would simply be transferred to the dead biomass carbon pool, also accounted for in this project and therefore not a loss of carbon.

It is at times difficult to quantify the likelihood of natural risks when these risks occur infrequently. By definition likelihood is the historical average number of times an event has occurred over the last 100 years. Another term often used when referring to the likelihood of natural risk is the return interval. The return interval is common in literature pertaining to fire and flooding (e.g., the 100 year flood). While the likelihood or return interval would also be useful for assessing pest and disease as well as geologic risk, a key feature when calculating the likelihood or return interval is that an event has occurred enough times in enough places such that there is sufficient data to calculate the return interval. A review of the literature revealed little data to support a return interval for the project area for either pest and disease or geologic risk. For this reason, we have assigned each risk a return interval of “once every 100 years or more.”

Score for Each Natural Risk Applicable to the Project (Determined by (LS × M)	
Fire (F)	2
Pest and Disease Outbreaks (PD)	0
Extreme Weather (W)	0
Geological Risk (G)	0
Other natural risk (ON)	
Total Natural Risk (as applicable, F + PD + W + G + ON)	**2**

A2.0. OVERALL NON-PERMANENCE RISK RATING AND BUFFER DETERMINATION

A2.1. Overall Risk Rating

The overall risk rating calculated using the VCS AFOLU Non-Permanence Risk Tool is calculated below.

Risk Category	Rating
a) Internal Risk	21
b) External Risk	0
c) Natural Risk	2
Overall Risk Rating (a + b + c)	**23**

The Envira Amazonia Project will employ a non-permanence risk deduction of 23%.

A2.2. Calculation of Total VCUs

Ex-ante estimates, including deductions to be deposited in the AFOLU pooled buffer account, are detailed in Section 3.4 of the project document.

APPENDIX B. FOREST CARBON INVENTORY STANDARD OPERATING PROCEDURES

B1.0 Forest Inventory Design

B1.1 Objective and Monitoring Approach

The inventory objective is to produce an estimate of forest biomass carbon stocks per unit area with precision of +/-15% of the mean with 95% confidence for the project area.

B1.2 Carbon pools

The inventory will sample and/or estimate forest carbon stocks in the following pools:

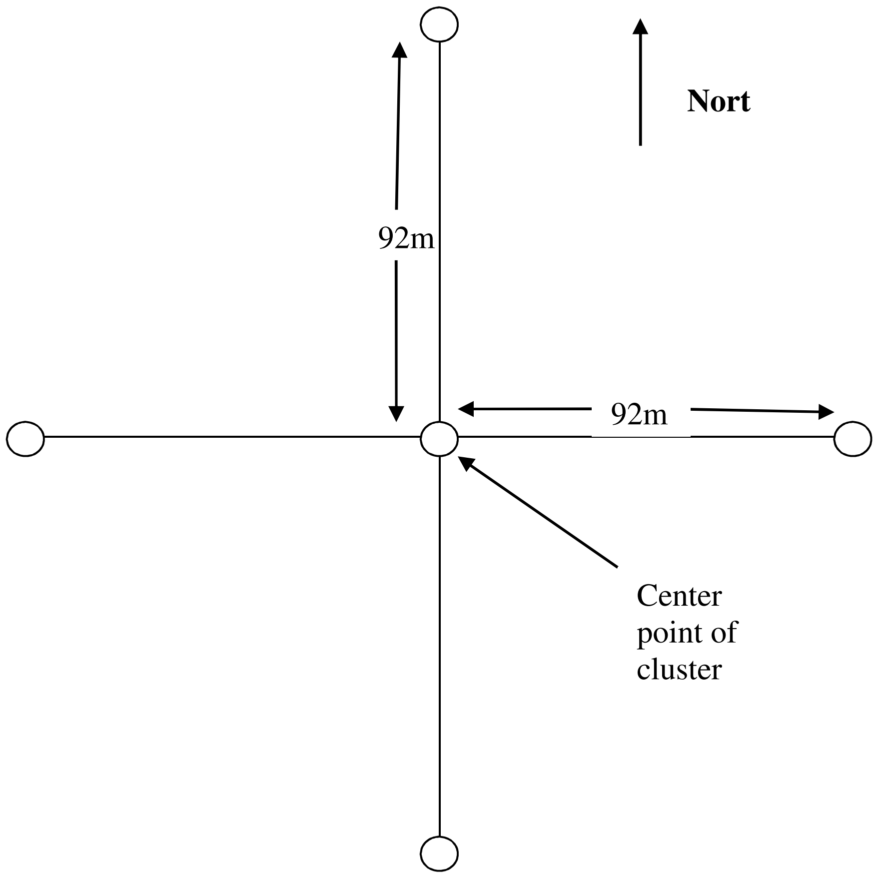
- Aboveground live tree biomass (including palms)
- Belowground live tree biomass
- Standing dead wood
- Lying dead wood

B1.3 Sampling design

The inventory employs stratified random sampling with clusters of five 23m radius circular plots ≈ 0.83 ha (configuration of the cluster is detailed below).

B1.4 Cluster configuration

The project employs cluster sampling, using the configuration below:



Map coordinates of sample points correspond with center point of the cluster above.

B2.0 Standard operating procedures

B2.1 Marking Cluster Center

Once a cluster center location is reached, the center point will be marked with a stake securely planted in the ground, to which an aluminum tag is attached. The tag is labeled with the cluster number. UTM coordinates of the cluster center will be recorded, if altered from the prescribed location.

B2.2 Measuring and Recording Slope

The slope (in %) of each plot will be measured with a clinometer. The slope will be recorded so the plot dimensions can later be adjusted to calculate the equivalent horizontal area.

B2.3 Measurement of Live Trees

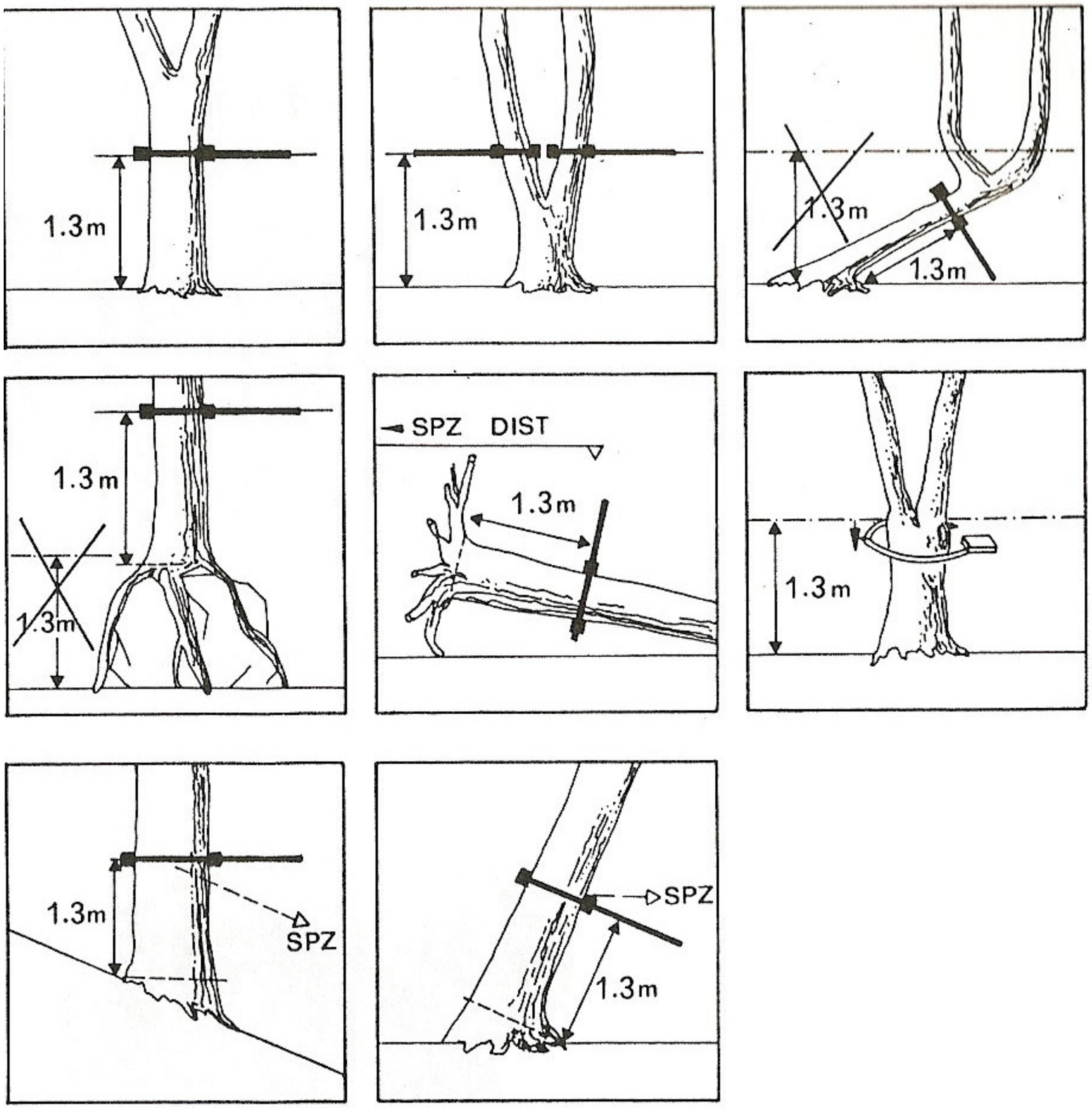
Within each plot all stems $\geq$ 10 cm dbh will be measured and species recorded. Diameter of all trees will be measured at breast height (1.3 m above ground level, see Figure B2.1) if the base of the tree is located within the sampling plot. In cases where the base of the tree is enlarged and buttress roots are present to help stabilize the tree, and this enlargement extends above 1.3 m, the diameter of these buttressed trees will be measured directly above the point of termination of the buttress (Figure B2.2). The termination of the buttress is most often characterized by the presence of an abrupt angle change along the bole of the tree due to the presence of the buttress roots. This abrupt angle change distinguishes buttressed roots from butt swell.

Species (or genera or common name) will also be recorded. When it is difficult to identify whether a tree is alive of dead, make a small scratch on a branch to see if the cambium layer, directly below the bark, is green. Alternatively, a small cut on the trunk should be made, where branches cannot be reached, to check for a green cambium layer or presence of sap.

In each plot, height to the base of the crown of the three tallest trees will be measured with a clinometer.

Where palms are encountered that meet the minimum dbh threshold, two measurements will be taken: basal diameter and height to the top of the stem.

Figure B2.1a. Point of measurement of diameter at breast height (from Pancel[67], 1993).



[67] Pancel, L., ed. 1993. Tropical forestry handbook. Berlin, Germany, Springer-Verlag. Volume 1, 738 pp.

Figure B2.1b. Point of measurement on trunk with previous fork or split bole.

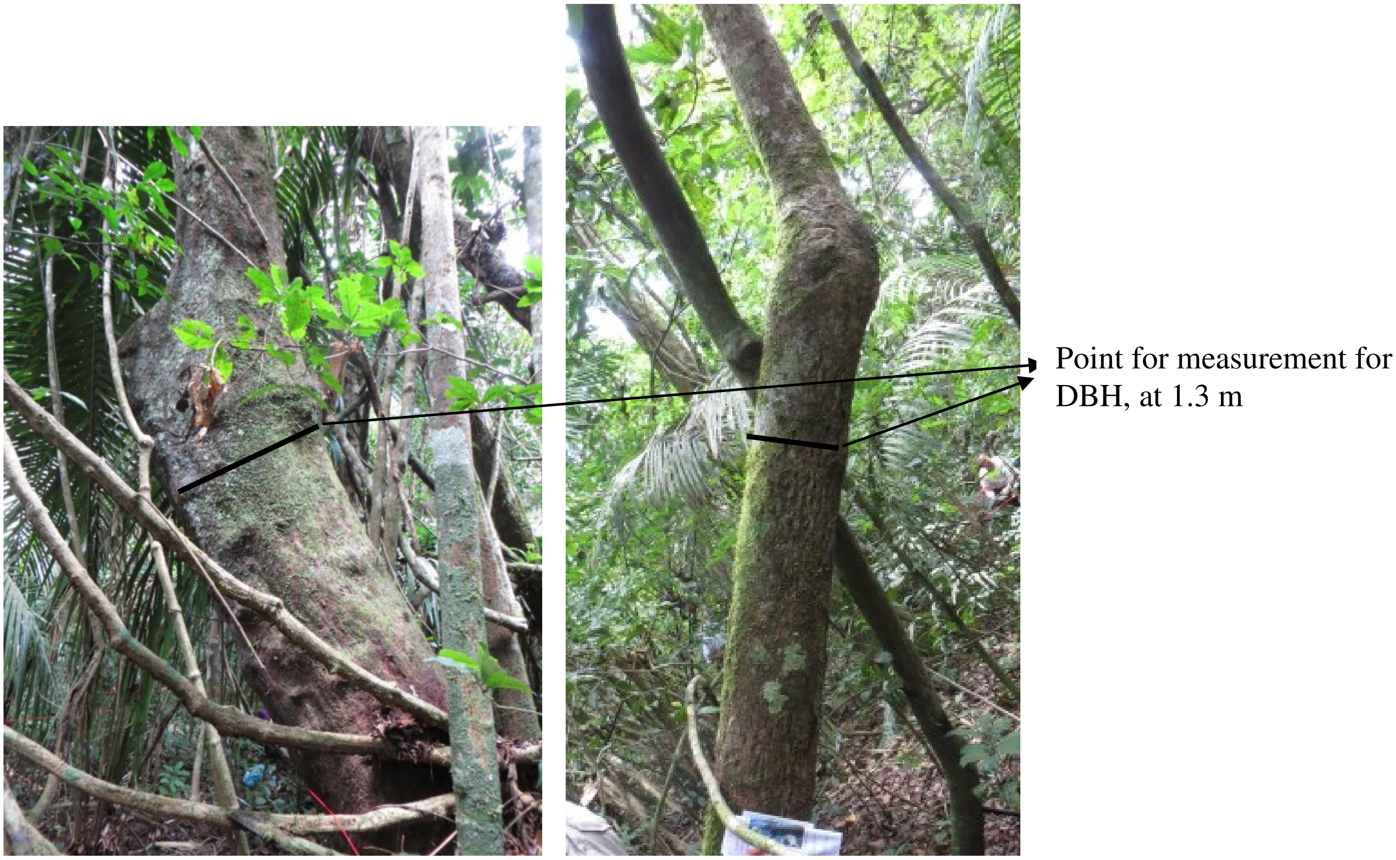
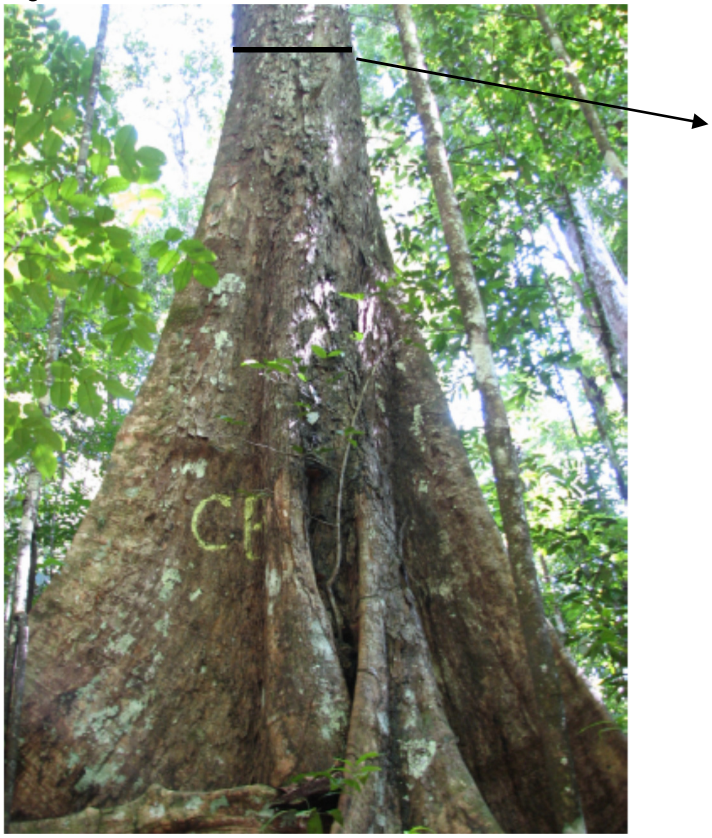


Figure B2.2. Point of measurement for diameter at breast height of a buttress tree.

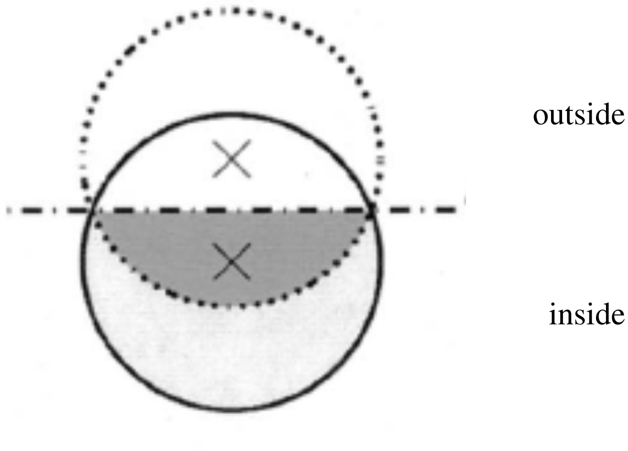


B2.4 Boundary Issues

In the event that a plot overlaps the project property boundary or strata boundary, the plot will be corrected using the mirage method[68] (Figure B2.3). The solid-lined circle is the actual plot border. The portion of the circle above the horizontal line is outside of the forest strata being sampled. After sampling all the trees within the plot within the forest strata (e.g. below the line), the trees within the grey shaded area will then be registered twice on the data sheet to account for the same area which is above the horizontal line and outside the plot.

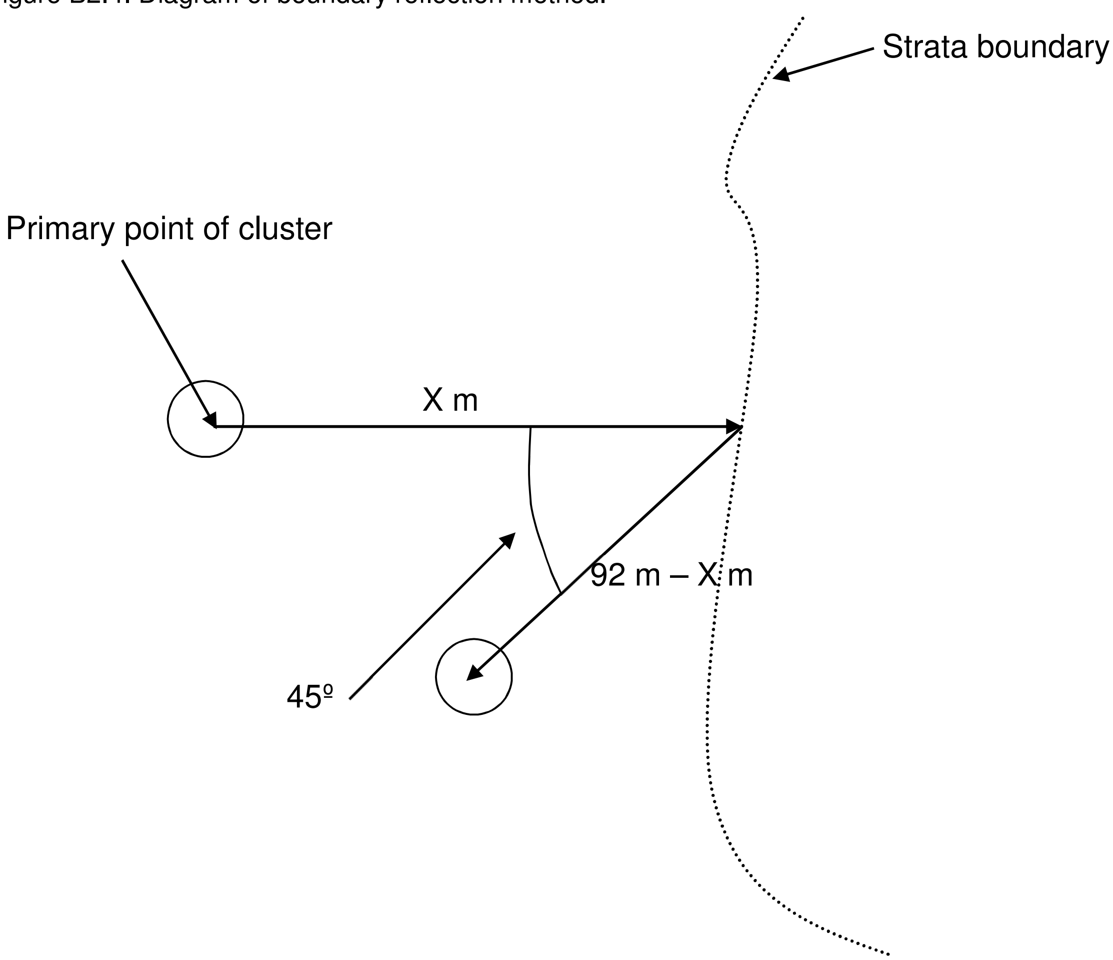
[68]Avery, T.E. and H.E. Burkhart. 1994. Forest Measurements. Fourth Edition. McGraw Hill, Boston, Massachusetts, USA. 408 pp.

Figure B2.3. Diagram of mirage method (Avery and Burkhart, 1994).



Where the 92 meter lines of transit from the cluster center cross the project or strata boundary prior to terminating, lines will be deflected from the boundary back into the project area using a “ricochet” method to complete the 92 m, where the line of transit will ricochet back into the project area to the right of the original bearing at a 45 degree angle.

Figure B2.4. Diagram of boundary reflection method.



B2.5 Dead Wood

Dead wood measurements will be restricted to pieces of dead wood with a diameter $\geq$ 10 cm.

B2.5.1 Measurement of standing dead wood

Standing dead trees will be measured using the same plots used for live trees.

The decomposition class (not to be confused with dead wood density class) of the dead tree shall be recorded and the standing dead wood is categorized under two decomposition classes:

1) Tree with branches and twigs that resembles a live tree (except for leaves);

2) Tree with signs of decomposition (other than loss of leaves) including loss of twigs, branches, or crown.

For decomposition class 1, diameter at breast height is measured and recorded as per protocols for live trees. For decomposition class 2, the following measurements/assignations are taken:

- dead wood density class (sound, intermediate or rotten)
- basal diameter
- height to the base of the crown (or total height if the crown is gone)

Note that all standing deadwood with a diameter > 10 cm is to be measured regardless of height, ensuring that stumps less than 1.3 m tall are measured as very short standing dead trees.

B2.5.2 Measurement of lying dead wood

Lying dead wood will be sampled using the line intersect method using the two 92-meter lines forming two axes of the cluster. The two directions sampled should be to the north and east. Only when a project boundary is encountered should the south or west line be sampled. The two directions sampled should form a right angle if possible, to ensure lying dead wood is not oversampled in the case of windthrow in a dominant direction. Where exceeding 15%, the slope (in %) of each line will be recorded with a clinometer. Along the lines, the diameters of all lying dead wood ≥ 10 cm diameter intersecting the lines are measured at the point of intersection.

A piece of lying dead wood should only be measured if (a) more than 50% of the log is aboveground and (b) the sampling line crosses through at least 50% of the diameter of the piece (where it intersects the end of a piece).

Each piece of dead wood measured is also assigned to one of three dead wood density classes (sound, intermediate or rotten) using the ‘machete test.’

B2.6 Determining the Density of Dead Wood

During the field inventory, a representative sample of dead wood should be collected to determine the average density for each density class. Thirty samples of dead wood should be collected for each density class, giving you a total of 90 samples. Cut a full disc of the selected piece of dead wood using a chain saw or a hand saw. Green volume (cm^3) is determined in the laboratory using a water displacement method standardized by ABNT[69] or the Brazilian Association of technical rules. Volume is determined by

[69] The norm number is ABNT NBR ISO 11941.

first saturating the sample in water for up to three days until a constant weight is reached. Next a beaker is placed on a balance and partially filled with distilled water. The sample is submerged in the beaker by pressing down with a needle/wire, the level of water therefore rises, and the reading on the balance is as if one has added the amount of water equivalent to the volume of the sample. Therefore the reading on the balance is equal to the volume of the sample (with the equivalence 1 g= 1 cm^3). This technique thus fills all the voids in the sample and gives the true volume of the sample. The disc is then dried in an oven (80-110°C) in the laboratory to constant weight (g). Density is calculated as dry mass (g) divided by volume (cm^3).

B3.0 Quality control

Implementation of the monitoring plan will apply QA/QC procedures as outlined here to minimize errors in measurement and data recording. This section covers procedures for: (1) collecting reliable field measurements and (2) documenting data entry.

B3.1 Field Measurements

Field crews will be fully trained in all aspects of the field data collection and adhere to field measurement protocols. Field crew leaders will be responsible for ensuring that field protocols are followed to ensure accurate and consistent measurement. Pilot sample plots shall be measured before the initiation of formal measurements to appraise field crews and identify and correct any errors in field measurements. To ensure accurate measurements, the height of diameter at breast height (1.3 m) will be periodically re-assessed by personnel during the course of the inventory.

B3.2 Data Entry

Data will be recorded on field sheets and then transcribed to electronic media. To minimize errors in data entry, where they are not the same, personnel involved in data entry and analysis will consult with personnel involved in measurement to clarify any anomalous values or ambiguities in transcription. A subset of the field sheets will be checked to ensure that data transcribed to electronic media is consistent with data on the field sheets. Database searches will be made following data entry to identify any anomalous values that require clarification or correction, including a review of all trees larger than 1 m dbh where an error in an individual tree value can have a disproportionate effect on strata level biomass estimates.