THE RUSSAS PROJECT

A Tropical Forest Conservation Project in Acre, Brazil

Document Prepared By
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Project Title	The Russas Project
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1 PROJECT DETAILS

1.1 Summary Description of the Project

The Russas 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). Project activities intended to reduce deforestation are implemented in and around a privately-owned property in the State of Acre, Brazil and are funded by payments related to emission reduction credits generated by the project.

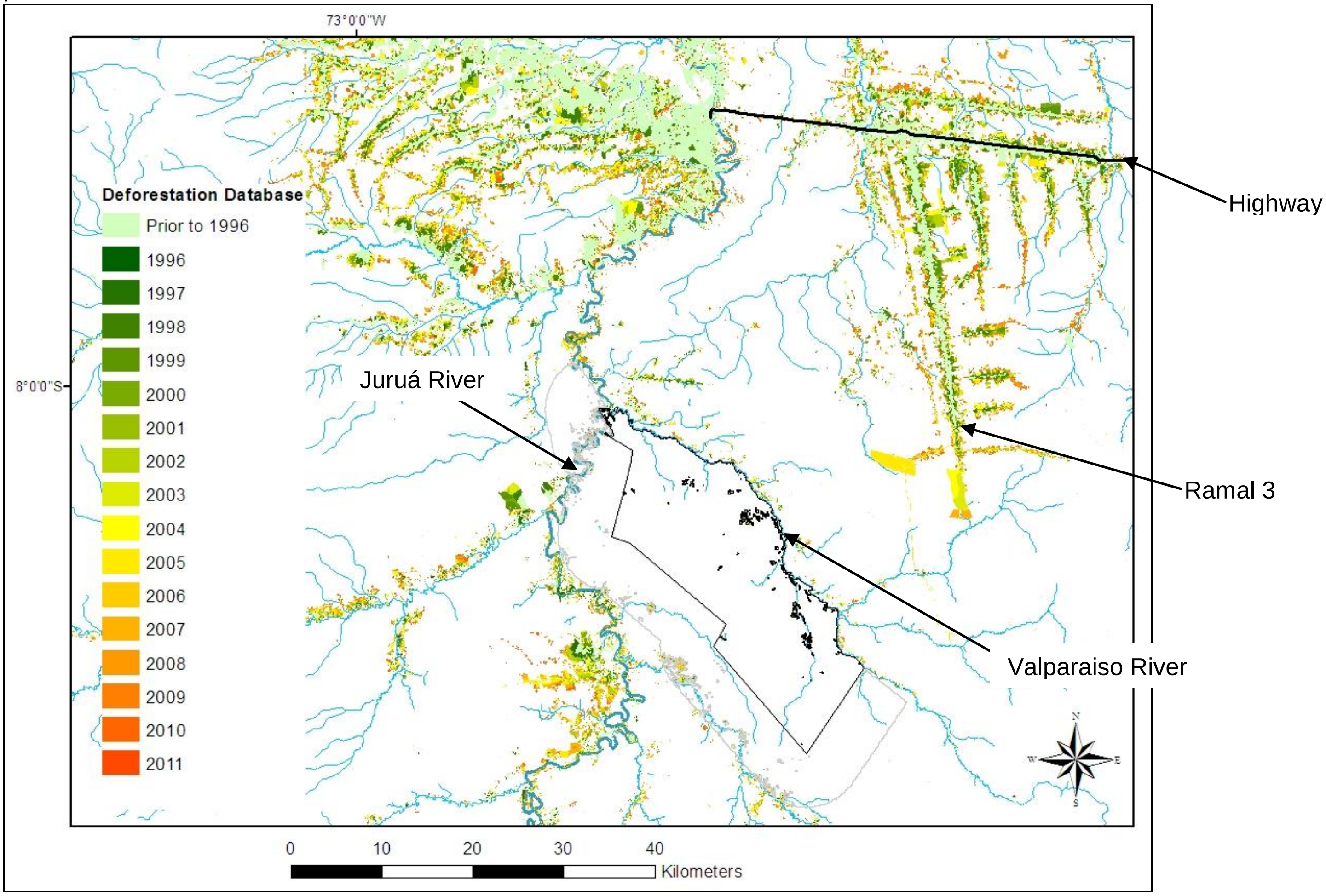
This project is being developed and registered under the Verified Carbon Standard (VCS) and the Climate, Community and Biodiversity Standard (CCBS). Project development involved meeting with the local communities surrounding the project area, engaging Acre state officials working on similar strategies at a regional/state level, developing a plan which will result in lowering the pressure on land and forest resources in consultation with the local community, and putting into operation the REDD project implementation plan with the help of local partners and Russas Project staff. Activities implemented as part of the project to reduce deforestation include:

- Community outreach and education;
- Employment of local community members as forest guards or other project staff (to replace other sources of income associated with deforestation and land use);
- Providing agricultural extension training which will help baseline agents to increase productivity on current lands (thus reducing the pressure to expand their farms in the adjacent forest);
- Supporting local farmers association;
- Assist communities in obtaining land tenure; and
- Sharing a portion of carbon related revenue for communities living on the Russas property (replacing other sources of income associated with deforestation and land use).

The above activities will directly address deforestation pressures in the region which are becoming more prevalent.

While the State of Acre historically has a low deforestation rate and a high level of forest governance, the paving of two primary roads BR-364 and BR-317 has greatly increased destruction of primary forests and conversion to cattle pastures. Deforestation pressures in the project region have increased significantly in the past several years as the paving of BR-364 is nearing completion. Upon being fully paved, BR-364 will allow for year-round transportation and will increase property values and market access and facilitate immigration. The Juruá River, a major tributary of the Amazon River, borders the project property and connects areas upstream and downstream from BR-364 to consumer markets. Further, secondary roads, such as “Ramal 3”, are fast approaching the project area (Figure 1.1) providing access to previously hard to reach areas for the agents of deforestation, small scale/subsistence farmers.

Figure 1.1. Deforestation in and around the project area (outlined in black) in the historical reference period.



There are 20 communities living on the project property, all of which live in close proximity to the Valparaiso River. These small scale and subsistence farming communities are the agents of deforestation and clear a portion of forest for land to engage in small scale farming and ranching for their livelihoods. Forest is generally cleared over a period of months. The process most often starts in May or June at the beginning of the dry season with the cutting of small trees and vines by machete. Next, the farmer or someone with a chainsaw cuts the larger trees down. The farmer then waits for the dead vegetation to dry for a period of time ranging from two weeks to several months. A portion of the farmers, then use fire to clear the land. Finally crops are planted or the land is converted to pasture.

The project baseline has been developed after meeting with local communities to understand their use of the land, and in light of the above mentioned increased accessibility of the project area in the near future. Further, the Russas Project is working closely with the State of Acre and is using a simple historic approach to setting the baseline to conform to Acre State's approach, which is still in development. Finally, data and information provided by the UCEGEO, the Climate Change Institute's GIS department of the state of Acre, was used in the development of the baseline.

There are three project proponents undertaking the Russas Project including CarbonCo, LLC ("CarbonCo"), Freitas International Group, LLC ("Carbon Securities"), and I.S.R.C. Investimentos e Acessória LTDA ("I.S.R.C."). CarbonCo, the wholly-owned subsidiary of Carbonfund.org, is responsible for project finance and managing project development. Carbon Securities acts as a liaison between CarbonCo and I.S.R.C. and provides logistical support during site visits. Ilderlei Souza Rodrigues Cordeiro is the land owner and sole proprietor of I.S.R.C., an Acre based organization which is primarily responsible for implementation of project activities and day-to-day management of the Russas Project.

A schedule of the important aspects of the project is listed in chronological order in Table 1.1, below.

Table 1.1. Schedule of Key Project Activities.

Project activity	**Date**	**Source/Notes**
Project start date	March 17, 2011	The local project manager, Marmude Dene de Carvalho, was hired on this date and forest monitoring began. Further, Ilderlei Souza Rodrigues Cordeiro spoke with the community on this date at length about REDD+, forest conservation, community benefits and the community signed an "ata" which is basically a public meeting MOU.
Start date and end date of the initial REDD project crediting period.	March 17, 2011 to March 16, 2041	
Validation/ Registration of the project	Anticipated 2013	
Date at which the project baseline will be revisited. The baseline must be renewed every 10 years from the project start date.	March 17, 2021	Start of second baseline period

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 Unplanned Deforestation (AUDD)

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 3.3 and VCS AFOLU Requirements[2]. The project will reduce emissions from unplanned frontier deforestation.

[1] VCS. 2012 VCS Standard. Version 3.3, 04 October 2012. Verified Carbon Standard, Washington, D.C.
[2] VCS. 2012 Agriculture, Forestry and Other Land Use (AFOLU) Requirements. Version 3.3, 04 October 2012. Verified Carbon Standard, Washington, D.C.

1.3 Project Proponents

The three main project proponents are CarbonCo, LLC (“CarbonCo”), Freitas International Group, LLC (“Carbon Securities”), and I.S.R.C. Investimentos e Acessória LTDA (“I.S.R.C.”) which is a sole proprietorship managed by the Russas property land owner. 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 I.S.R.C., acts as a translator, and assists with logistics for site visits. I.S.R.C. is an Acre, Brazil-based organization created by the Landowner and is primarily responsible for day-to-day management of the Project and the implementation of activities to stop deforestation. Table 1.2, below, details the role and responsibilities of each project proponent.

Table 1.2. List of Project Proponents.

Contact	Role	Responsibility
CarbonCo, LLC 3 Bethesda Metro Center, Suite 700 Bethesda, Maryland 20814 USA 001-240-247-0630	Project developer	• Finance project development costs • Manage technical contractors helping with project development, the forest carbon inventory, and baseline modeling • Assist with drafting the VCS and CCBS Project Documents • Manage validation and verification process including contracting auditors and addressing Corrective Action Requests
I.S.R.C. Investimentos e Acessória LTDA Bairro: Zona Rural, Cidade: Cruzeiro do Sul - Acre - Brasil, Cep: 69.980-000	Project manager	• Engage with local community to inform and explain the proposed project and gather feedback, and resolve any local issues • Develop and implement a plan to reduce deforestation
Freitas International Group, LLC (Carbon Securities) 201 S. Biscayne Boulevard, 28th Floor Miami, Florida 33131 USA 55-61-3717-1008	Project facilitator	• Serve as a liaison and translator for the landowners and CarbonCo, including establishing meetings with landowners and relevant stakeholders, arranging site visits, providing information and documentation such as previous studies, photographs, and satellite images related to the project

1.4 Other Entities Involved in the Project

Figure 1.2 provides an overview of the relationship of the various project proponents and entities involved in the project. Table 1.3 lists the role of the other entities.

Figure 1.2: Organizational Chart for the Russas Project

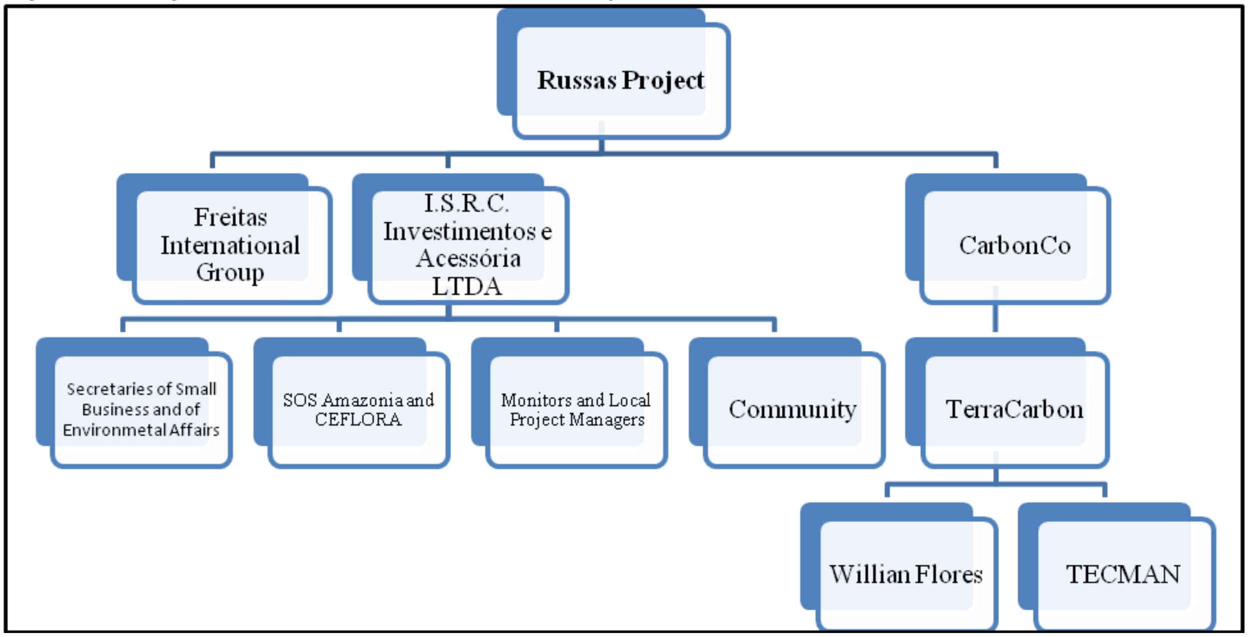


Table 1.3. List of Other Entities Involved in the Project.

Contact	Role	Responsibility
TerraCarbon LLC 5901 N. Sheridan Rd. Peoria, Illinois 61614, USA 001-434-326-1144	Independent Consultant	Co-lead project kickoff. Design and manage forest carbon inventory. Lead baseline development task. Develop project document and advise CarbonCo on all aspects of project development.
TECMAN Rua Copacabana, nº 148, Sala 204, Conjunto Village Maciel, CEP 69.914-380 Rio Branco, Acre, Brasil 55-68-3227-5273	Independent Consultant	Lead and supervise collection of field data during the course of the forest carbon inventory.
Antonio Willian Flores de Melo Universidade Federal do Acre Centro de Ciências Biológicas e da Natureza, Distrito Industrial, CEP 69.915-900 Rio Branco, Acre, Brasil 55-68-3901-2611	Independent Consultant	Assist with review of the project baseline.
S.O.S. Amazônia Rio Branco - AC Rua Pará, 61 Cadeia velha CEP 69.900-440 Phone: 55 68 3223 1036		Provide technical assistance with regard to agricultural extension training for local communities

CEFLORA, Centro de Formação e Tecnologia da Floresta or the Center for Training and Forest Technology Rua Paraná , 865 Cruzeiro do Sul - Acre		Provide technical assistance with regard to agricultural extension training for local communities
Secretaries of Small Business and Environmental Affairs Environmental Affairs Rua Rui Barbosa n. 514 – Cruzeiro do Sul – Acre – CEP: 69.980-000 CNPJ n. 04-012-548/0001-02 – Phone: (0**68) 3322-4295 Email: prefeituraczs@bol.com.br Semmam.czs@gmail.com Small Business Secretaria de Estado de Pequenos Negócios Avenida Ceará, nº 1624 - Centro (em frente ao Colégio Aplicação) Phone: (68) 3224-2548 or 3224-7674 or 3224-3364 Email: josecarlos.reis@ac.gov.br		Provide technical assistance with regard to agricultural extension training for local communities

1.5 Project Start Date

The Russas Project has a project start date of March 17, 2011. The local project manager, Marmude Dene de Carvalho, was hired on this date and forest monitoring began. This is also the date Ilderlei Souza Rodrigues Cordeiro spoke with the community at length about REDD+, forest conservation, community benefits and the community signed an "ata" which is a public meeting MOU.

1.6 Project Crediting Period

The Russas Project has an initial project crediting period of 30 years, starting on March 17, 2011. The initial baseline period started on March 17, 2011 and is set to continue through March 16, 2021. The initial project crediting period is set to end on March 16, 2041.

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

The Russas Project is not considered to be a “Large Project”, as the estimated annual emission reductions for the first baseline period is 125,591 tCO_2e per year, less than the 300,000 tons of CO_2 per year which indicates a “Large Project”.

Project	X
Large Project	N/A

Years	Estimated GHG Emission Reductions (tCO2e)
2012	21,094
2013	114,912
2014	138,728
2015	133,395
2016	140,807
2017	125,100
2018	141,920
2019	150,389
2020	133,177
2021	156,391
Total estimated ERs	1,255,912
Total number of crediting years	10
Average annual ERs	125,591

1.8 Description of the Project Activity

The Russas Project will mitigate 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 and the preservation of biodiversity.

Over the Project Lifetime, I.S.R.C. will implement the following project activities:

- Raise Project Awareness
- Hire Project Manager
- Patrol and Monitor Deforestation
- Provide Agricultural Extension Services
- Support Local Farmers Association
- Help Communities Obtain Land Tenure

- Profit-Sharing of Carbon Credits
- Establish a Project Headquarters

Raise Project Awareness

The local communities are an essential component of the Russas Project and have been frequently involved in discussions. Community meeting discussions have revolved around the following topics:

- The Project Proponents roles and responsibilities;
- What exactly is the Russas Project and how long the Project will last;
- The negative impacts of deforestation and alternatives to slash-and-burn agricultural practices;
- Financial benefits to practicing more sustainable agriculture;
- What type of social projects and programs (e.g., preventative medicine and health care services) are most relevant and useful;
- What agricultural trainings could be offered;
- Grievance procedure for addressing any and all unresolved issues; and
- The process for securing land tenure.

Through meeting with the communities, the Project Proponents have been able to gain the communities' insights about project design and to better incorporate the communities into the Project. The community objective of generating sustainable economic opportunities and implementing social projects and programs will be best achieved with active, on-going participation and input from the local communities.

Ilderlei has been working with the communities of the Russas and Valparaiso Project prior to discussions about developing REDD+ Projects. Ilderlei began working with the Russas Project property in 2003. In the beginning, the community discussions focused on alternative economic activities such as the collection of vines and sustainable wood management. Upon running for Vice-Mayor of Cruzeiro do Sul and later as a Federal Congressman for the State of Acre, Ilderlei regularly visited the Russas and Valparaiso communities to better understand their needs. In 2009, Ilderlei spoke to Normando Sales (now the owner of the Purus Project) about the general concepts of REDD+. Starting in late 2009 and throughout 2010, Ilderlei held some initial, informal meetings with the communities about REDD+.

Throughout 2011, 2012 and 2013, the Russas Project was discussed in greater detail with the communities to ensure the communities were fully aware of the Russas 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.

Community members who wanted to join the Russas Project signed an "ata" on March 17, 2011. This "ata" asked local community for a commitment to: stop deforestation and logging, help prevent access of non-residents to the project area, and create and join anti-fire squads. In return, community members requested: the ability to explore the large amount of açaí existing in the area, help to increase and improve production of cassava flour in nonforested areas, and to learn new management techniques for artisanal fisheries. Further, I.S.R.C. agreed to keep communities informed on the development and implementation of the Russas Project and to assist communities in realizing the activities and benefits requested.

Figure 1.3. Community meeting for the Russas Project (Photo by Ilderlei Cordeiro).

Hire Project Manager

Marmude Dene de Carvalho ("Marmude") was hired by I.S.R.C. in March 2011 as the Russas Project's local project manager. As the local project manager, Marmude works as a partner in the Project, facilitating communication in community decisions. Marmude lives onsite and is able to frequently visit neighboring communities. Marmude is responsible for helping implementation of social projects, assisting with the community, biodiversity, and deforestation monitoring, and regularly communicating with I.S.R.C.

Patrol and Monitor Deforestation

Marmude Dene de Carvalho began monitoring of deforestation via boat in March 2011. Monitoring takes place on a monthly basis along the Valparaiso and Jurua Rivers. Marmude spends on average approximately 15 days per month visiting communities, monitoring for deforestation, and going to Cruzeiro do Sul to meet Ilderlei.

When deforestation is identified by I.S.R.C., it is documented and then CarbonCo is notified. Collectively, CarbonCo and I.S.R.C. will discuss the appropriate actions to counteract 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

In the future, I.S.R.C. will hire another person to monitor deforestation and will purchase a motorcycle or a four-wheeler to monitor areas of high deforestation risk including along property boundaries and existing paths in the forest, and nearby roads approaching the property.

Patrolling / monitoring for deforestation has already begun and such activities will last throughout the Project Lifetime. Patrolling / monitoring will provide an early detection of deforestation, while also enabling the Project Proponents to identify the specific drivers and agents of deforestation and to implement the appropriate actions to mitigate such deforestation.

Provide Agricultural Extension Services

The communities in and around the Russas Project were surveyed to better understand which agricultural extension training courses would be of the most interest.

I.S.R.C. will provide requested agricultural extension services. I.S.R.C. has engaged the State of Acre's CEFLORA (Centro de Formação e Tecnologia da Floresta or the Center for Training and Forest Technology), the Secretary of Small Business, the Secretary of Environmental Affairs for the Municipality of Cruzeiro do Sul, and S.O.S. Amazônia to assist with onsite trainings to the communities in and near the Russas Project.

Agricultural extension trainings will assist the Project Proponents achieve both the climate and community objectives of the Russas Project. These activities will reduce the communities' dependence on forest resources through intensifying agriculture and livestock, while also providing the communities with alternative incomes that are not dependent on additional deforestation.

Support Local Farmers Association

I.S.R.C. will establish and financially support a community run local farmers association. Financial support will help to:

- modernize community manioc houses;
- build a local processing plant to industrialize açaí production;
- support purchase of new equipment;

- assist with improving production by mechanization of the land; and
- facilitate better market access.

Help Communities Obtain Land Tenure

Community members that have been living on the land and who made the land productive (e.g., by growing crops or raising livestock) for ten years have the right to title this land. I.S.R.C. will assist families living on the Russas property obtain title and further will recognize whatever area is currently deforested and under productive use by each family up to the recommended size that a family in the State of Acre needs for a sustainable livelihood according to State and Federal laws. All communities, whether they join the Russas Project or not, will be titled the land they have put under productive use. This formal recognition of the community's land tenure and the ability of communities to access credit (i.e., due to their property collateral) will reduce GHG emissions as communities will have greater responsibility and ownership over their land.

Profit-Sharing of Carbon Credits

Carbon revenue will be primarily used by I.S.R.C. to develop social projects and programs. However, within the first five years, communities will start to receive a small share of the payments from I.S.R.C. This revenue will be shared with the communities each time I.S.R.C. receives payment for its share of the verified emission reductions. Regarding the criteria for allocating carbon revenue among communities, only communities that voluntarily join the Russas Project, successfully avoid deforestation, and reside within the Russas property will be eligible for carbon revenue. These communities will be granted a percentage of I.S.R.C.'s gross carbon revenues.

Establish a Project Headquarters

The project has an initial headquarters in the project manager's house, and in the future I.S.R.C. will build a dedicated project headquarters near Marmude's house at the beginning of the Valparaiso River. This headquarters will provide a local project office with phone, a space for community meetings and teaching courses, a small auditorium for presentations, a place for visitors to sleep and eat, and project storage. Building an office contributes to the community objective because the office will serve as a centralized headquarters and will facilitate I.S.R.C.'s social projects and programs.

Figure 1.4. Initial Russas Project headquarters.

1.9 Project Location

The Russas Project area is located in Acre, Brazil along the southern bank of the Valparaiso River. The Valparaiso River is a tributary to the Juruá River and joins about 40 km south of the town Cruzeiro do Sul. The total project area (i.e., forested area of the property as of the project start date, and 10 years prior) is 41,976 hectares.

Figure 1.5. Map of the Russas Property.

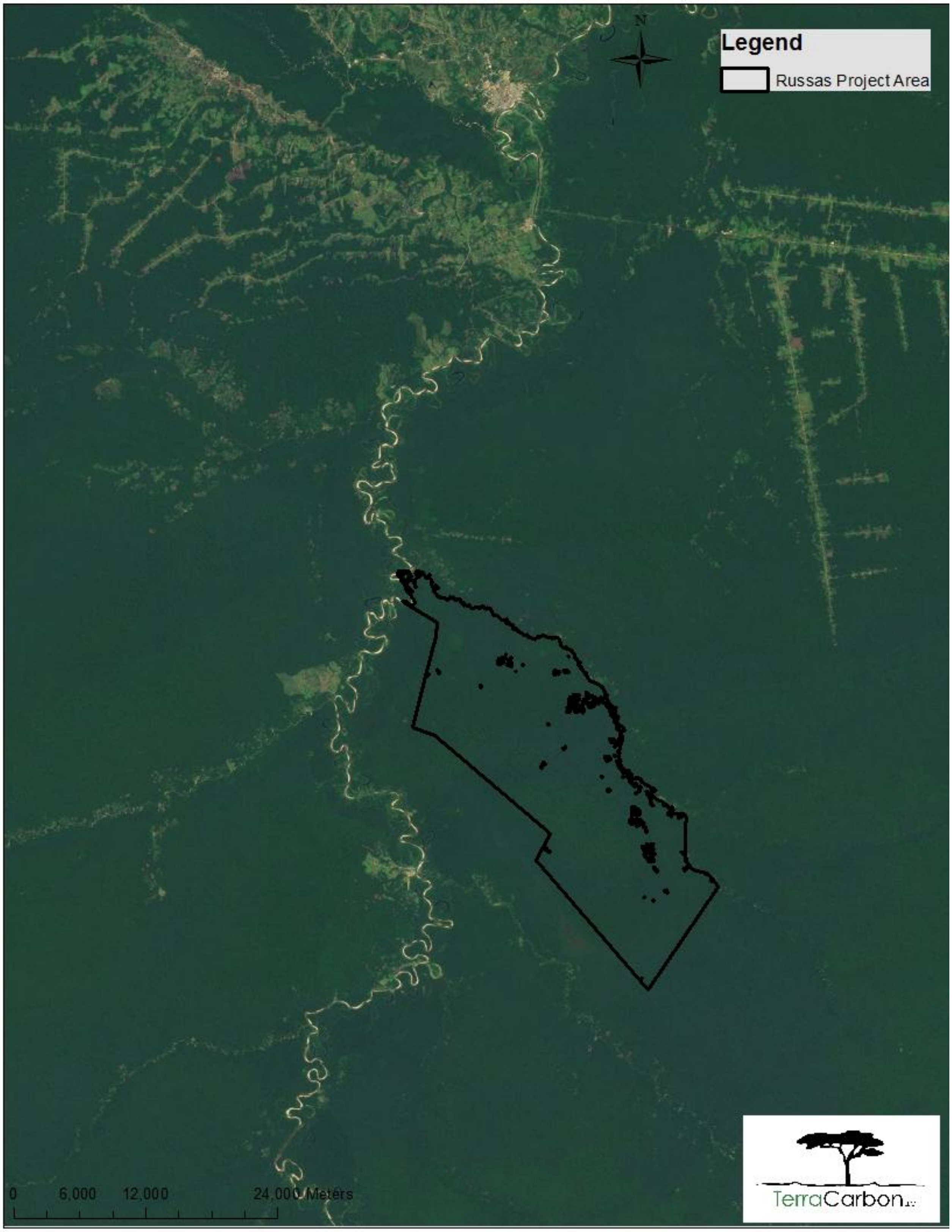


Figure 1.6. 2001 Forest Cover Map (Green = Forest; Red = Nonforest).

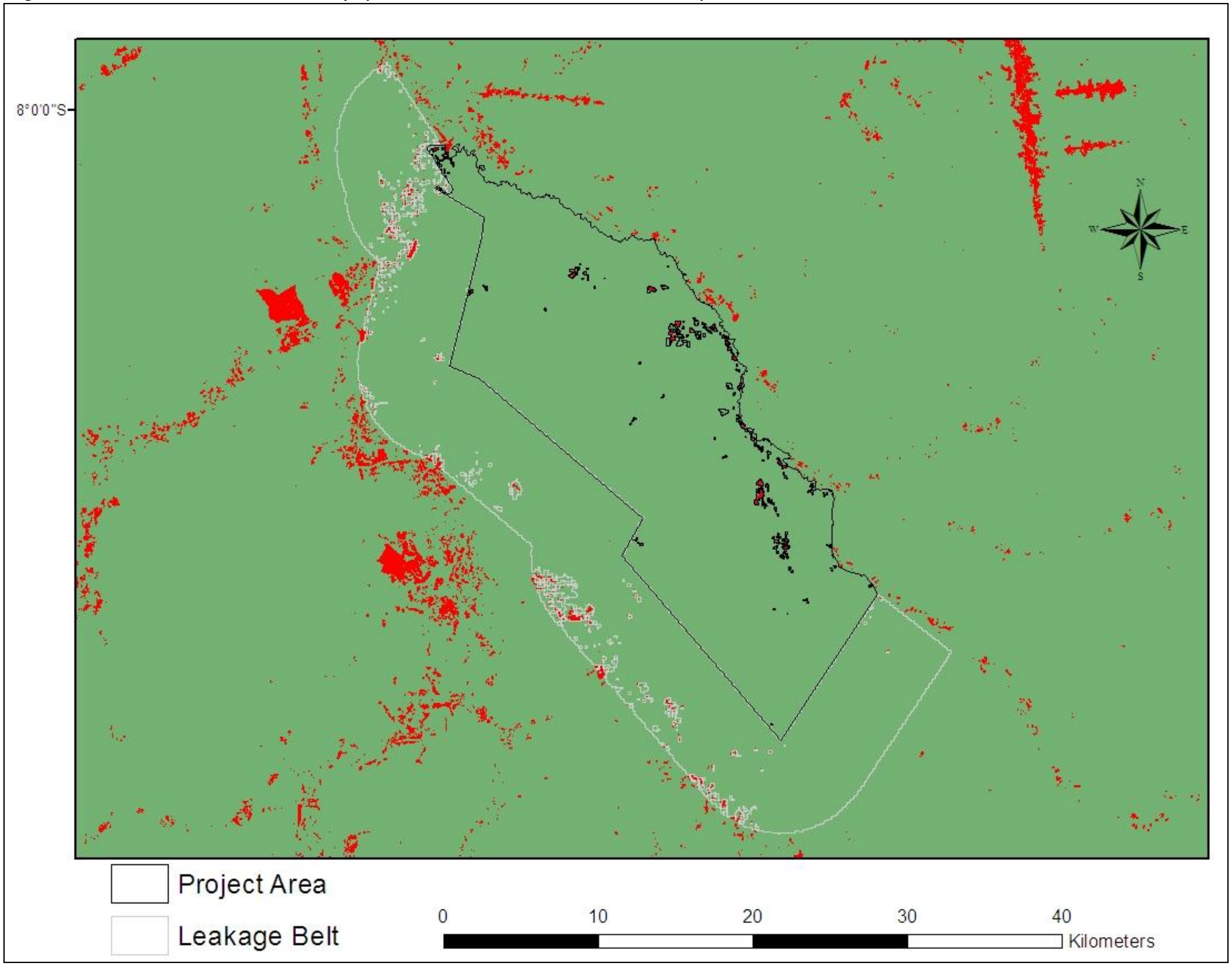
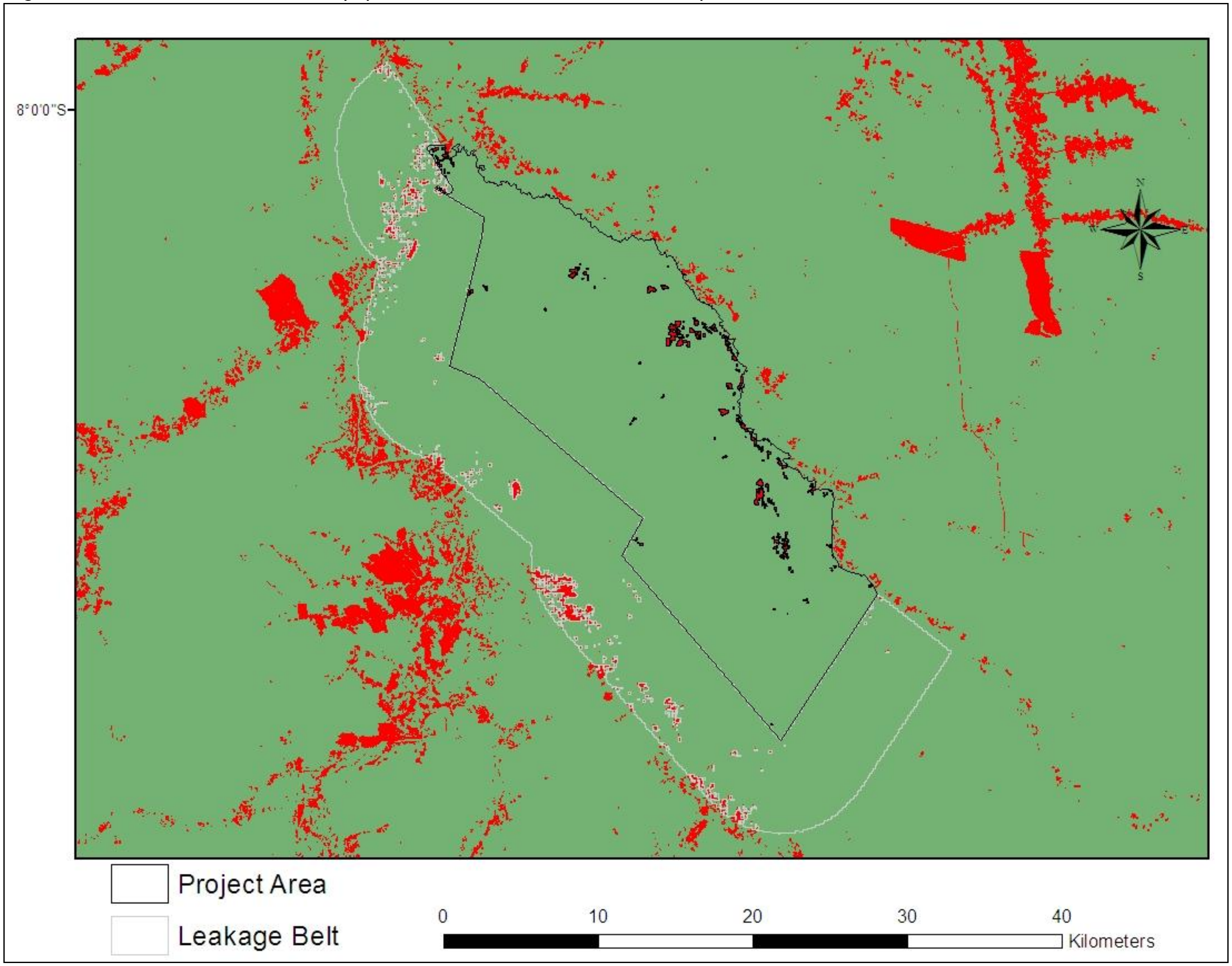


Figure 1.7. 2011 Forest Cover Map (Green = Forest; Red = Nonforest).



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. Further, 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 to the conservation of the project area. Further, I.S.R.C. was established specifically to promote environmental causes including conservation of tropical rain forest, including the project area, and implement projects 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], while the average annual rainfall is 1,950-2,250 mm/yr. The rainfall in the project area is around 2,200 mm/yr (see Figure 1.8). 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 Russas 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 1.9). There are five strata present in the Russas Project area include: open forest with bamboo and palm (FAB + FAP), open palm forest (FAP), open alluvial forest with palm (FAP - Alluvial), open forest with bamboo and palm and dense forest (FAP + FAB + FD and FAP + FD + FAB), and dense forest and open palm forest (FAP + FD and FD + FAP).

One additional stratum is present in the leakage belt, namely open alluvial forest with bamboo (FAB - Alluvial). This forest type is hard to distinguishable from FAP-A, with the primary difference being the prevalence of bamboo.

Soils

The Russas Project area is dominated by Acrisols and Gleysols. Also present to a much lesser extent are Plinthosols and Fluvisols, soils typically found near rivers (see Figure 1.10). Acrisols (or Argissolos in Portuguese) are clay rich soils associated with humid tropical climates. These soils have low fertility and high levels of aluminum. Gleysols (or Gleissolos in Portuguese) are hydric soils that are saturated with groundwater for long periods of time. This soil saturation leads to the development of a characteristic

[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 FlS 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.

gleyic color pattern with reddish, brownish or yellowish colors in surface horizons and grayish or blueish colors for deeper horizons. Fluvisol (or Neossolos in Portuguese) are young soils formed on alluvial plains in the region where periodic flooding is common. While this deposition leads clear stratification, soil horizons are generally weakly developed, although a distinct topsoil horizon may be present. Plinthosols (or Plintossolos in Portuguese) form near rivers in this area. These soils are weathered iron/aluminum rich clay soils which are considered acidic and nutrient-poor. Iron often accumulates in the form of plinthite below a strongly leached eluvial horizon. 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 or leakage belt.

Rivers

The Juruá River is one of the longest tributaries to the Amazon River[6]. It is an important river linking the Ucayali region of Peru with the states of Acre and Amazonas in Brazil (See Figure 1.11). Throughout Acre, the Juruá River runs from south to north toward the state of Amazonas. The course of the Juruá River is not set and meanders within the stream bed in the dry season. Erosion of the banks of the Juruá River is typical after the wet season as the river level drops[7]. A secondary river, the Valparaiso, runs along the northern border of the property and provides year round access to the project area.

History

Historically, the property was used for rubber tapping and an extractive area for natural forest products. More recently and prior to the acquisition of the property by the current landowner in 2004, there was little oversight of local activities on the property, some of which lead to deforestation on the Russas property.

[6] Instituto Brasileiro de Geografia e Estatística, "AC-Politico," ftp://geoftp.ibge.gov.br/mapas/tematicos/politico/AC_Politico.pdf

[7] 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.

Figure 1.8. Precipitation isolines (30 year average 1961-1991) in the vicinity of the project area and leakage belt.

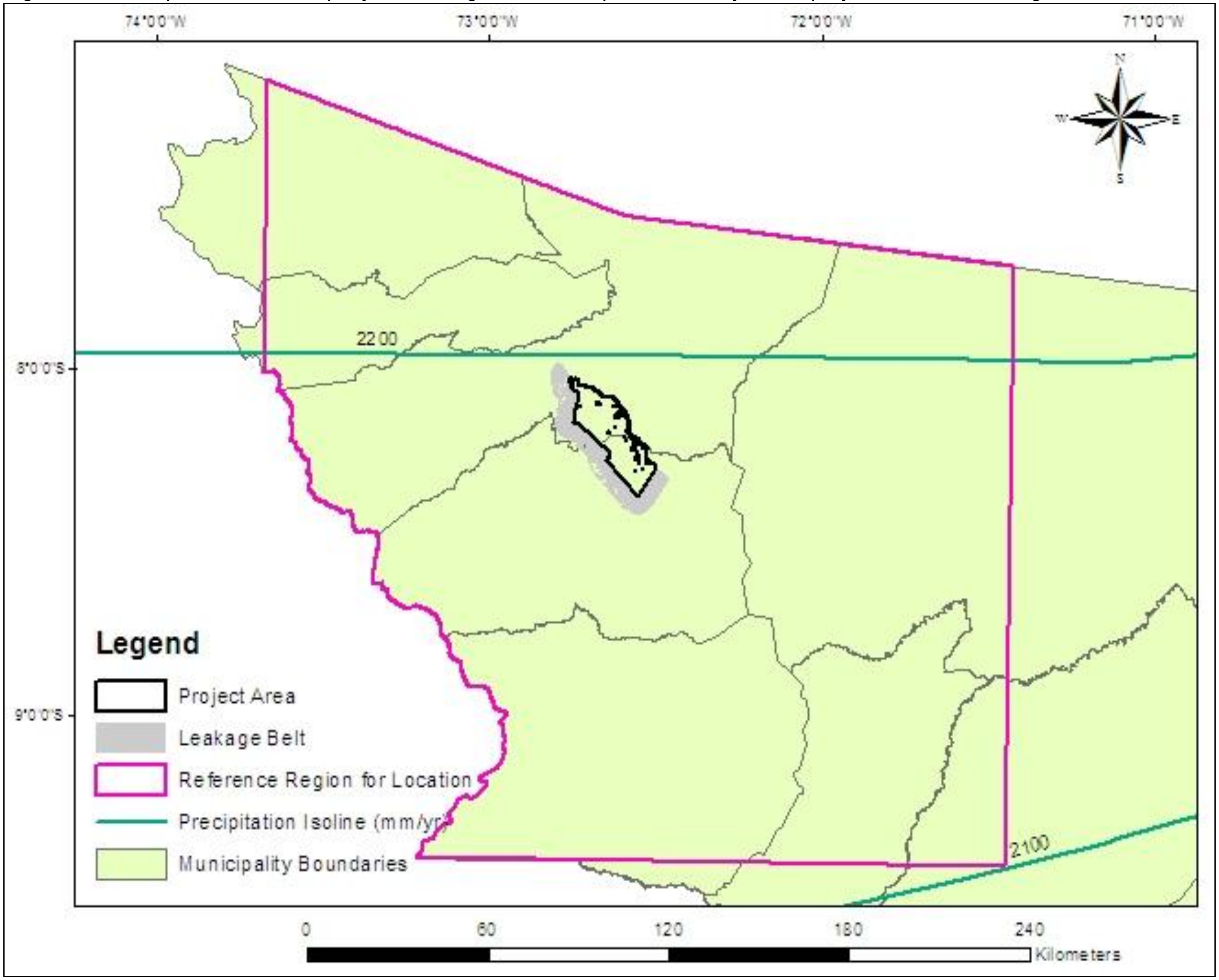


Figure 1.9 Vegetation strata in the vicinity of the project area.

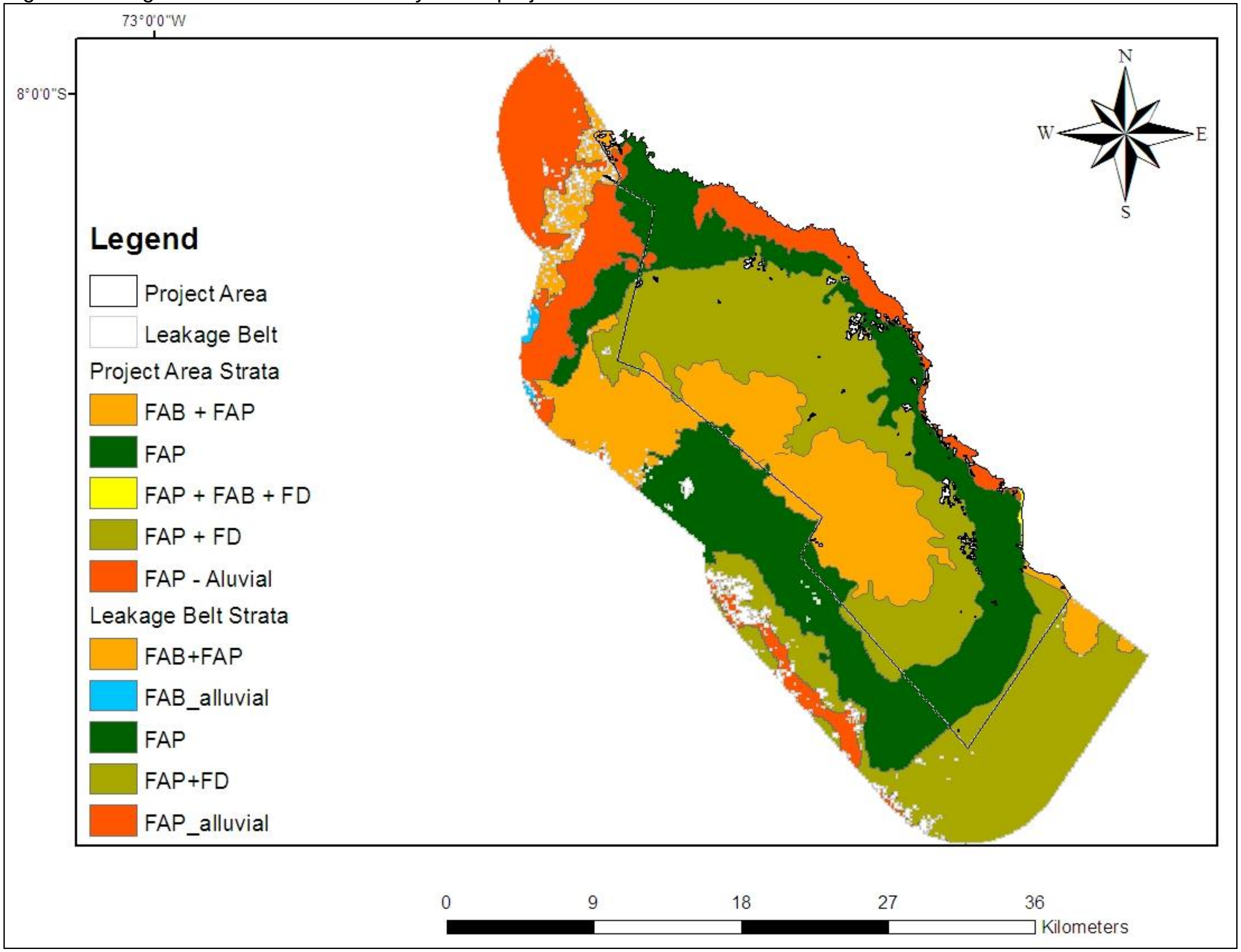


Figure 1.10. Soil type in the vicinity of the reference region for location.

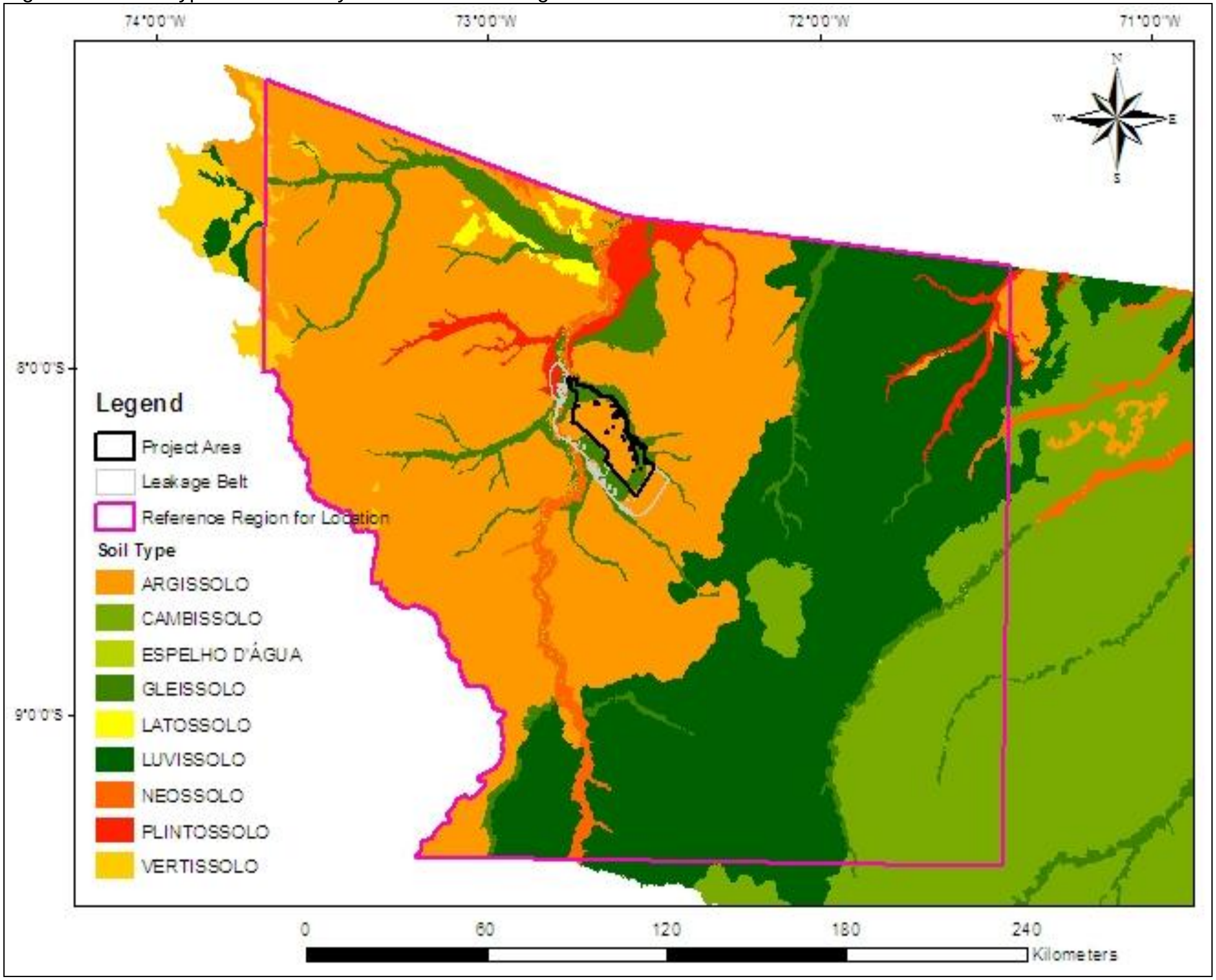
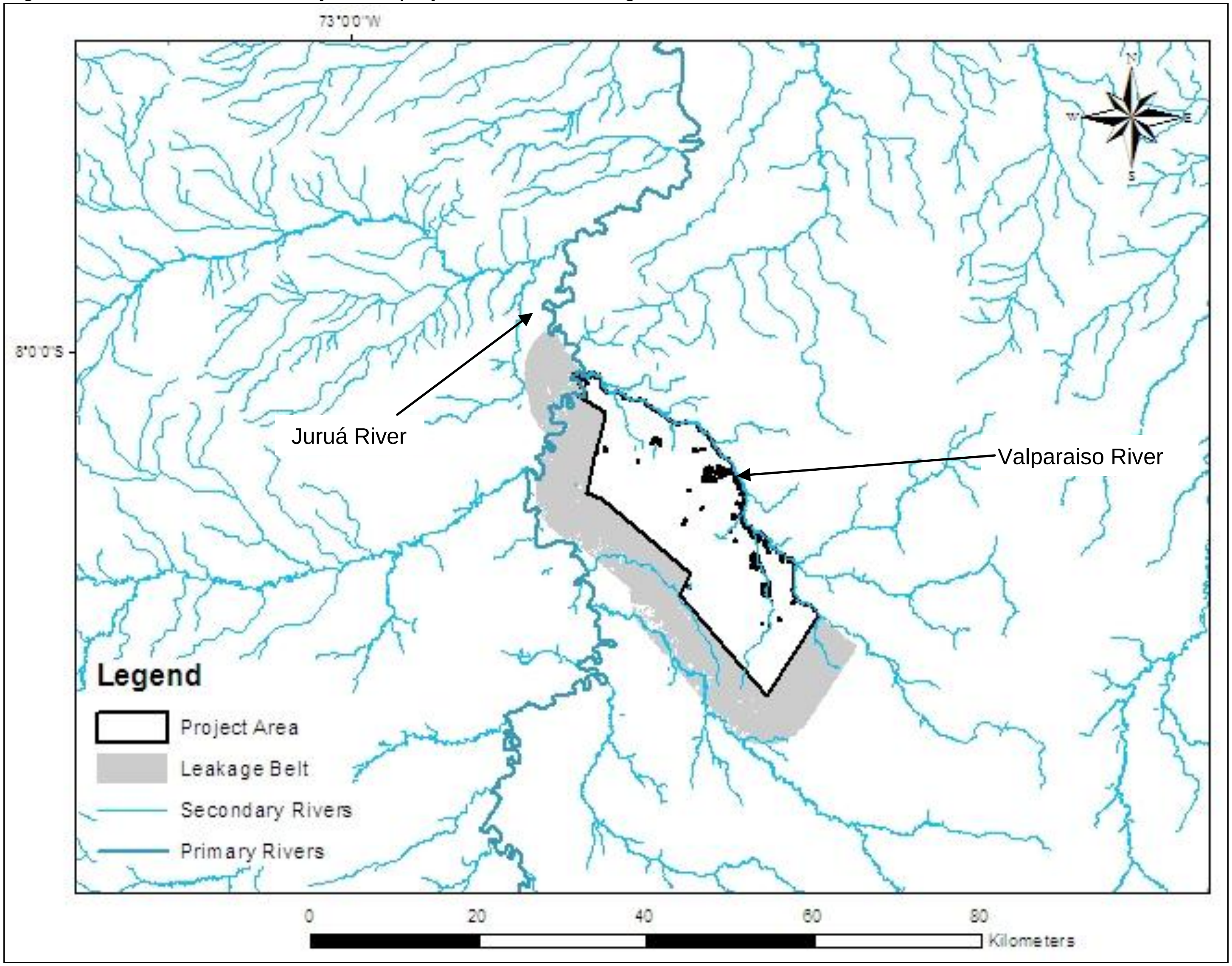


Figure 1.11. Rivers in the vicinity of the project area and leakage belt.



Local communities

There are 20 communities living on the project property along the banks of the Valparaiso and Jurua Rivers. These communities engage in small scale/subsistence farming and ranching (Figure 1.12). In addition, these communities hunt and gather in the forest surrounding their farms. Fuelwood collection is sustainable and no resources extracted from the forest are for commercial markets, but rather are used for a largely subsistence livelihood. The main crop in the region of the project is manioc (i.e., yuca or cassava). Additional typical crops and fruit trees include: bananas, beans, corn, papaya, rice, sugarcane, and watermelons.

Figure 1.12. Baseline land-use practices among communities include cattle-ranching and small scale agriculture.

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

All project proponents have maintained compliance with relevant local, state, and national laws, statues and regulatory frameworks.

National Laws and Regulatory Frameworks

The Russas Project abides by Brazilian national laws including the Brazilian Constitution. Chapter 6 of the Brazilian Constitution specifically discusses environmental issues in Article 225[8] , 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 Russas Project.

These include:

- The original Brazil Forest Code entitled, Law No. 4771, September 15, 1965.[9]
- Revision of Brazil Forest Code under Law No. 7803, July 18, 1989.[10]
- Provisional Measure under No, 2166-67, August 24, 2001.[11]
- Revision of Brazil Forest Code under Law No. 12.651 of May 25, 2012.[12]

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.[13] Many of these provisions have been revised since 1965.

[8] Georgetown University, “1988 Constitution, with 1996 reforms in English,” http://pdba.georgetown.edu/Constitutions/Brazil/english96.html#mozTocId920049
[9] Presidency of the Republic, “Law No. 4771, September 15, 1965,” Available: http://www.planalto.gov.br/ccivil_03/Leis/L4771.htm
[10] Presidency of the Republic, “Law No. 7803, July 18, 1989,” Available: http://www.planalto.gov.br/ccivil_03/leis/L7803.htm
[11] Presidency of the Republic, “Provisional Measure 2166-67, August 24, 2001,” Available: https://www.planalto.gov.br/ccivil_03/MPV/2166-67.htm
[12] 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
[13] 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 Russas 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.[14]

Compliance with Law

The Russas Project have identified, consulted and shall continue to work with the relevant agencies responsible for environmental protection, particularly with respect to REDD projects. Furthermore, the Russas 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.[15]

Compliance with Law

The Russas 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.

[14] Presidency of the Republic, "Law No. 6.938, August 31, 1981," Available: http://www.planalto.gov.br/ccivil_03/leis/L6938.htm
[15] 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 Russas 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.[16]

Compliance with Law

As mentioned previously, the Russas 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.[17]

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).

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.

[16] Presidency of the Republic, "Provisional Measure 2166-67, August 24, 2001," Available: https://www.planalto.gov.br/ccivil_03/MPV/2166-67.htm
[17] 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

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 Russas 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

With respect to the Project Zone, there are communities settled onto what were originally privately-owned lands and these communities have cleared the land primarily for subsistence agriculture, some 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,[18] passed on October 5th, 1988
- Brazilian Civil Code,[19] which is the Federal Law 10406, passed on January 10th, 2002
- Brazilian Civil Procedure Code,[20] 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).

[18] Presidency of the Republic, "CONSTITUIÇÃO DA REPÚBLICA FEDERATIVA DO BRASIL DE 1988," Available: http://www.planalto.gov.br/ccivil_03/Constituicao/Constituicao.htm
[19] 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
[20] 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 the Russas Project, nobody in the community has title or good-faith possession, because none of them bought the land from the landowner Ilderlei Souza Rodrigues Cordeiro. 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, I.S.R.C. will voluntarily recognize whatever area is currently deforested and under productive use by each family. All communities - whether they voluntarily join the Russas 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 Russas 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 Russas 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.[21]

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.”[22]

Compliance with Law

As a tropical forest ecosystem services project, otherwise known as REDD, the Russas 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.

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

[22] 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 Russas 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[23]

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).[24] 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).[25] 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 Russas 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.
- CSLL (Social Contribution on Net Corporate Profit), Lei Federal 7689/1988: This regulation is the social contribution calculated on net profit.

[23] Massachusetts Institute of Technology, "Brazilian Constitution," Available: http://web.mit.edu/12.000/www/m2006/teams/willr3/const.htm
[24] 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
[25] 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

- 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 Russas 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 Russas 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.[26],[27]

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. I.S.R.C. 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, I.S.R.C. 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.

[26] Personal Correspondence with Mr. Leonardo Silva Cesário Rosa, Federal Prosecutor
[27] 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
- Georeferenced property delineation.

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 for 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). Federal tax issues and liens associated with the Landowner and the project property, were assessed using the CPF, CNPJ and Imóvel Rural (NIRF) using the Secretariat of the Federal Reserve of Brazil website.[28]

Finally, Carbon Securities and CarbonCo visited the IBAMA, or Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis, website[29] to ensure IBAMA has not blocked landownership titles due to noncompliance with environmental laws and regulation associated with a particular property. State and municipality level documentation[30] further demonstrated authentic land ownership. These local authorities in Acre are able to provide up to a 100-year history of landownership for the properties.

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).[31]

José D.G. Miguez, Executive Secretary of the Brazilian Interministerial Commission on Global Climate Change, presented on March 18, 2003 at the Organisation for Economic Co-operation and Development (OECD) Global Forum on Sustainable Development: Emissions Trading Concerted Action on Tradeable 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.[32] This said, 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.

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[28] http://www.receita.fazenda.gov.br/grupo2/certidoes.htm
[29] IBAMA, "Certidão Negativa de Débito," Available: http://www.ibama.gov.br/sicafiext/sistema.php
[30] Ministry of Justice of Brazil, "Cadastro de Cartório do Brasil," Available: http://portal.mj.gov.br/CartorioInterConsulta/consulta.do?action=prepararConsulta&uf=AC
[31] 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
[32] José D.G. Miguez, "CDM in Brazil," Available: www.oecd.org/dataoecd/9/6/2790262.pdf

The Tri-Party Agreement documents the transfer of some portion of these carbon rights from Ilderlei Souza Rodrigues Cordeiro to CarbonCo and Carbon Securities.

1.12.2 Emissions Trading Programs and Other Binding Limits

No emission reductions generated by the 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 Participation under Other GHG Programs

The Russas Project has not been registered, nor is seeking registration, under any other GHG programs. The Russas Project is seeking registration under the Climate, Community and Biodiversity Alliance Standard.[33]

1.12.4 Other Forms of Environmental Credit

The 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.[34]

1.12.5 Projects Rejected by Other GHG Programs

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

Leakage Management

Project level leakage mitigation activities are largely directed toward helping small scale farmers in the surrounding communities reduce the need to clear lands in the leakage belt. Leakage management activities are largely the same as the project activities, as the target audience, local communities are the same. Leakage management activities include:

- The Russas Project is working in unison with the Valparaiso Project, which is the largest adjacent landowner to the Russas Project;
- Community outreach and education;
- Potential employment as project forest guard or other project staff (replacing other sources of income associated with deforestation and land use);
- Agricultural extension training will help baseline agents to increase productivity on current lands, (thus reducing the pressure to expand their farms in the adjacent forest); and

[33] The CCB project document is available at http://climate-standards.org/projects/
[34] Forest Trends, “Our Initiatives,” http://www.forest-trends.org/#

- Monitoring illegal deforestation and degradation and reporting incidences to the proper authorities.

Leakage management activities (and project activities) directed at local agents of deforestation are more fully described in Section 1.8.

Leakage management activities directed at immigrant actors occur as part of state-wide initiatives to reduce deforestation and environmental degradation in Acre. The Russas Project proponents have met and interacted with State officials multiple times who are responsible for implementing these programs, as noted in Section 6.0, and intend to maintain close coordination with the State of Acre throughout project implementation.

Specifically, regarding state-wide actions, recent legislation passed by the State of Acre in October 2010 (Bill No 2.308, October 22 2010, established the State System of Incentive for Environmental Services or SISA. The SISA legislation helps further develop an Acre state run payment for environmental services (PES) scheme. Acre began its PES program in 1999 with subsidies to rubber tappers. The program in its current, more sweeping form was developed through an extensive public consultation process, receiving local and international input that concluded in April 2010. The law establishing the current PES program (SISA) was passed in October 2010.

The SISA program is composed of multiple programs covering a range of environmental services. Among these is the carbon program (Program ISA-Carbono) with multiple sub-programs for implementation (e.g., agriculture intensification) directed toward different populations/land ownerships in the state. It should be noted that the Program ISA-Carbono is not just REDD-focused, but rather includes all forest carbon (e.g., including reforestation).

The SISA program will be managed in part by the newly-created Regulation, Control and Registration Institute (RCRI), and will eventually be housed at “The Technology Foundation of Acre” (FUNTAC). According to Article 1 of the bill[35], it 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.

The Program ISA-Carbono was established to help create and implement economic and financial instruments to achieve emission reduction targets, improve infrastructure and instruments for

[35] State of Acre, Brazil. 2010. Bill No. 2.308: To create the State System of Incentives for Environmental Services (SISA). Unofficial translation.

measurement, quantification and verification, and to assist with registration and transparency. The PES scheme[36] anticipates the provision of the following services to help achieve the above goals:

- Technical Assistance and Rural Extension (ATER) for all segments of rural population;
- Mobilization, communication and strengthening of community organizations; and
- Strengthening of Municipal Plans for Prevention and Control of Deforestation and Fires.

Commercially Sensitive Information

There is no commercially sensitive information in this project description document.

Further Information

None.

[36] Acre Government. 2009. Payments for Environmental Services- Carbon Policy. Rio Branco, Acre, Brazil.

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

The Russas Project is utilizing the Avoided Deforestation Partners' VCS REDD Methodology, entitled, "VM0007: REDD Methodology Modules (REDD-MF)." The specific modules applied to the Russas Project are listed below.

REDD-MF, REDD Methodology Framework Version 1.4

<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 1.0

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

<u>Baseline Modules:</u>

BL-UP, "VMD0007 Estimation of baseline carbon stock changes and greenhouse gas emissions from unplanned deforestation," Version 3.2

<u>Leakage Modules:</u>

LK-ASU, "VMD0010 Estimation of emissions from activity shifting for avoided unplanned deforestation," Version 1.0

<u>Monitoring Module:</u>

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

<u>Miscellaneous Modules:</u>

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-UP and LK-ASU, is mandatory in the case of projects focusing on unplanned deforestation. 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 CP-D is mandatory as the dead wood pool is greater in the baseline than project 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 1.9, with complete forest cover demonstrated for the years 2001 and 2011.
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 1.10, no organic soils exist within the project area.
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 unplanned deforestation category, as the agents of deforestation are small scale farmers who do not have permission to convert forest in the project area to pasture and cropland.
Baselines shall be renewed every 10 years from the project start date.	The baseline will be renewed in March 2021.
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 Russas Project is not registered in any carbon trading scheme or program.
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 cropland or pasture, both of which prevent 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-UP, "VMD0007 Estimation of Baseline Carbon Stock Changes and Greenhouse Gas Emissions from Unplanned Deforestation"

Table 2.2. Applicability Conditions and Justifications for the VMD0007 Module.

Applicability Condition	**Justification**
Baseline agents of deforestation shall: (i) clear the land for settlements, crop production (agriculturalist) or ranching, where such clearing for crop production or ranching does not amount to large scale industrial agriculture activities; (ii) have no documented and uncontested legal right to deforest the land for these purposes; and (iii) are either resident in the reference region or immigrants. Under any other condition this framework shall not be used.	The baseline agents of deforestation clear the land for settlements, ranching and cropland. These small scale farmers have no legal right to use or deforest the land. These agents of deforestation are from nearby communities and in some cases immigrant actors looking for land to convert for agricultural uses.
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 occurs remains as forest as the amount of fuel wood collected (approximately 2.1 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 "The community uses fuelwood originating from dead wood, usually in areas cleared for agriculture (roçados). Rarely are live trees cut down for fuelwood" (pers comm). 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." Further, Mr. Agapejev de Andrade states: "There are no national or regional forestry or nature conservation regulations in relation to fuel wood collection for domestic use." Using responses to PRAs on the distance that community members enter into the forest to collect fuelwood, a conservative estimate of the size of the fuelwood collection area was calculated for each community as a circle with the distance traveled into the forest as the radius. Each rural resident in the municipalities of Cruzeiro do Sul uses on average 0.85 cubic meters of fuelwood per year[37]. The total volume of fuel wood extracted per community was then calculated as the number of

[37] http://www.ibge.gov.br/estadosat/perfil.php?sigla=ac#

	residents in the community multiplied by the average consumption of fuelwood per year. This volume of wood was converted to biomass using the species level mean wood density[38] for Amazonian forests of 0.62 g/cm3. The resulting values were divided by the collection area to get the biomass of fuelwood collected per unit area (tonnes d.m. ha-1). The average value for the 16 communities sampled in the project area was 2.1 tonnes d.m. ha-1 yr-1. As this value is less than the increase in above-ground net biomass (i.e., annual growth in forest biomass) in natural forests in South America (for forests greater than 20 years old with over 2,000 mm rain per year) fuelwood collection can be considered to be sustainable and does not lead to a systematic decrease in carbon stocks over time. Details of this analysis can be found in the project database.

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 baseline or 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

[38] Species level mean wood density for Amazonian forests of 0.62 g/cm3 calculated by Baker et al. (2004) and subsequently validated for western Amazonia by Anderson et al (2009) was used in this calculation

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	While CH_4 and N_2O emissions are conservatively excluded in the baseline, they are included in the 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	Excluded	Excluded as no commercial harvesting for wood products[39] takes place in the baseline (as part of the forest conversion process) or with project scenarios.
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 three 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" and CP-D, "VMD0002 Estimation of carbon stocks in the dead-wood pool".

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 per Step 1 of the tool, the following alternative land use scenarios were identified.

1. Continuation of pre-project land use with unabated threat of illegal deforestation.
2. Project activity on the land within the project boundary performed without being registered as a VCS AFOLU project.

All land use scenarios identified above are in compliance with applicable legal and regulatory requirements, except #1, which represents illegal deforestation not undertaken by the landowners or project proponents.

2.4.1 Continuation of the Pre-Project Land Use with Unabated Threat of Illegal Deforestation

While the pre-project land use for the project area was moist tropical forest, this land use is unlikely to continue in the future given land use change patterns and deforestation pressures in the area. Considering the deforestation on other parts of the Russas property (i.e., those areas outside the project area) and in the region in general, portions of the project area are increasingly likely to be deforested and converted to pasture and cropland by small scale farmers.

There are 20 small scale and subsistence farming communities living on the project property. These farming communities are the agents of deforestation. These communities clear a portion of forest for land to engage in small scale farming and ranching for their livelihoods. Forest is generally cleared over a period of months. The process most often starts in May/June at the beginning of the dry season with the cutting of small trees and vines by machete. Next, the farmer uses their own chainsaw or hires someone with a chainsaw to cut the larger trees down. The farmer then waits for the dead vegetation to dry for a period of time ranging from two weeks to several months. A portion of the farmers, then use fire to clear the land. Finally crops are planted or the land is converted to pasture. In cases where fire is not used, the land is planted or grazed without full clearing. In addition to clearing land, the agents of deforestation also rely on the forest surrounding their homesteads for fuelwood to make charcoal, for hunting and gathering, and on occasion for timber.

[39] The results of the community surveys indicated 0 of 16 communities responded yes to the question, "Do you sell timber?"

As the agent of deforestation is small scale farmers, rather than the landowners themselves, this deforestation is unplanned. This deforestation is technically illegal as these agents of deforestation do not have the permission to convert forest land to pasture or cropland; however, this deforestation is rarely prosecuted by authorities. The most likely baseline scenario is continued conversion of moist tropical forest to pasture and cropland by small scale farmers.

Noncompliance with private properties laws is widespread and laws are systematically not enforced in Acre State. Numerous inquiries have been made to relevant state and local authorities to obtain data on levels of enforcement (or e.g., percentage of illegal land invasions resolved) of private property laws. To our knowledge no institutions currently track these cases in a systematic fashion. The State of Acre in general has insufficient levels of government enforcement of property rights sufficient to prevent or remove illegal land invasions and stop deforestation in accessible areas. This is supported by a letter[40] dated 11 October 2012 from, the President of the Acre Lawyers Association, Dr. Florindo Poersch where he states:

> In my professional opinion, illegal deforestation in the State of Acre…[is] rarely controlled and/or prevented by institutions of environmental control, due to lack of technical personnel and staff of the State Acre to perform this control…
>
> Furthermore, the right to property in rural areas, in the case of invasion is difficult to apply in the State of Acre, due to lack of the judiciary's structure to escalate these demands quickly, and promptly remove invaders.

The likelihood of this scenario is further substantiated on the basis of analysis of historic deforestation and drivers, elaborated below.

2.4.2 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.

Effective forest conservation in the project area would be unlikely under any non carbon market-related scenario. The landowner does not have sufficient finances to protect the area and incentivize communities to participate in forest conservation, which is reflected by the 220 ha of deforestation that has occurred on the property prior to the project start since the landowner had acquired the property, and the increasing pressures as described above.

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 Russas 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.

[40] A copy of this letter is contained in the project database.

The project activity produces no revenue, as the project area will be managed for conservation purposes, rather than for commercial timber production, livestock, or crop production. Costs associated with implementing project activities, project development, and VCS project validation are significant. Additionally, while the project will incur ongoing costs (related to management and implementation of project activities including forest patrols, social programs, and payments for environmental services), 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 VCS-related income, thus making this REDD project impractical in the absence of carbon finance.

2.5.2 Common Practice

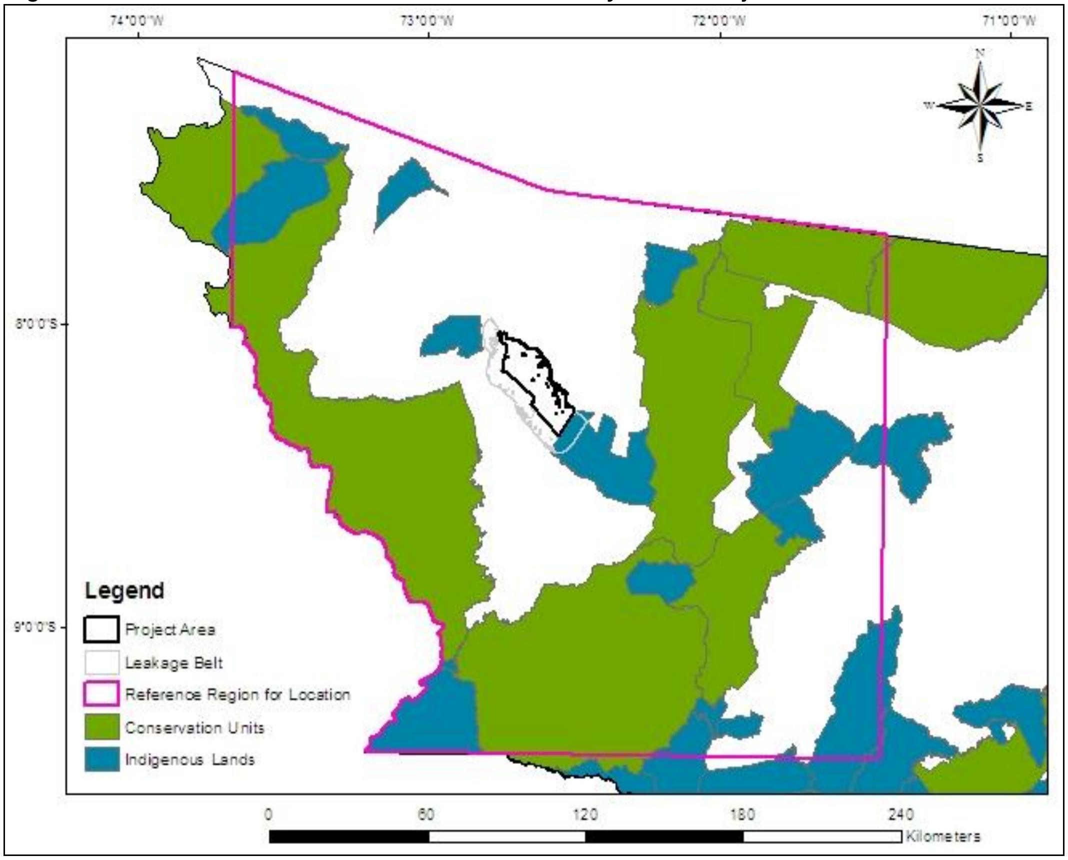
Conservation of privately owned forest land in Acre state is generally limited to designated areas of permanent protection (APP). One requirement of the Brazilian Forest Code is for landowners to maintain 80% of privately owned property as an APP. Regardless of this designation or the property owner's intentions to comply with the law, the APP areas continue to be subject to pressure from illegal deforestation.

It is possible to implement certain social and environmental programs without carbon financing, such as government assistance with agricultural extension. However, these measures on their own are not sufficient to incentivize small scale farmers in the area or new settlers to stop deforestation in and around the project area. It is only through the implementation of significant social and environmental programs, as well as implementation of forest protection measures, such as those documented in Section 1.8, that illegal deforestation can be reduced or prevented in the project area.

Publicly-funded forest conservation efforts on government lands exist. Other forest conservation efforts within Acre state include a series of national, state, and local conservation areas, and indigenous reserves (see Figure 2.1, below). However, to our knowledge, there are no privately funded projects on private lands with the aim of stopping unplanned 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 deter unplanned deforestation pressures on its land.

Figure 2.1. Forest Conservation Areas in the Vicinity of the Project Area.



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.

Trees in the Cecropia genus will not be included as part of the forest inventory. 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.

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.

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.[41]

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 r2 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 a parabaloid rather than the volume of a cylinder;

-Only stem biomass is estimated, thus conservatively excluding other aboveground biomass; and

- A conservative measure of basal diameter (i.e., dbh) was used.

The AVFOR parameter used in leakage estimation will be stratified using information and data derived from official (government) publications, peer-reviewed published sources, or other verifiable sources. Stratification is not limited to the delineation of different strata where contiguous areas of at least 100 ha differ in stocks by ≥20%.

[41] 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.

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 BASELINE EMISSIONS

Development of the project baseline emissions from unplanned deforestation, both rate and location, was conducted in conformance with the VCS modular REDD methodology VM0007, specifically the BL-UP module using the simple historic approach. The project meets the applicability conditions of this module as set out in Section 2.2.

3.1.1 Definition of Boundaries

Project boundaries for the development of the baseline include spatial and temporal boundaries from which information on the historical rate of deforestation is extracted and projected into the future. The rate of deforestation is derived from the reference region for rate, while the reference region for location is used in the spatial modeling component of the baseline. Finally, the leakage belt is the area surrounding the project area, where activity shifting leakage (i.e., deforestation which was displaced from the project area due to implementation of the project activities) is most likely to occur.

3.1.1.1 Spatial Boundaries

Reference Region for Projecting Deforestation Rate

The reference region for rate of deforestation (RRD) has a total area of 5,438,719 hectares[42] and is delineated as shown in Figure 3.1. It excludes the project area and leakage belt, and all nonforested areas at the start of the historical reference period in the year 1996. Further, the reference region has been defined with knowledge of the drivers of unplanned deforestation in the region.

The main agents of deforestation in the RRD are small scale farmers who intend on establishing or expanding pasture and croplands through conversion of forest. The proportion of agriculturalist to ranchers is the same in the RRD (and state as a whole) as is expected in the project area in the baseline case (i.e., 81% of the deforested areas in the state are pasture and 6% are cropland, State of Acre[43]) as landscape factors (i.e., soil type, vegetation type, and slope) do not drive agricultural decisions for small scale farmers (see Table 3.4). Where elevation is important, it drives the decision to deforest rather than whether the land will be converted to cropland or pasture.

Community surveys have been implemented in and around the project area and leakage belt to demonstrate the main agents of deforestation lack the legal rights to use the land, and to estimate the proportion of residents versus immigrants.

Maps of the landscape factors, including forest type, soil type, slope, and elevation, that were used to help define the reference region can be found in the project database, ensuring similarity to the project area. Incorporation of these landscape factors had little effect on delineating the RRD as almost all land in the state is suitable for conversion to pasture and agriculture. Further, as the agents of deforestation are

[42] The area of the RRD is larger than the minimum required (MREF). The MREF was calculated to be 182,794 ha.
[43] 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.

limited in their mobility, only areas within 65 kilometers of primary roads, which is similar to the project area, were included in the RRD.

Land tenure was also used to help delineate the RRD. Specifically, municipal, state, and federal forest conservation areas and indigenous reserves were excluded from the RRD as these differ from the privately-owned project area. Comparison of the area covered by landscape factors, transportation networks and human infrastructure are detailed in the Table 3.1 below.

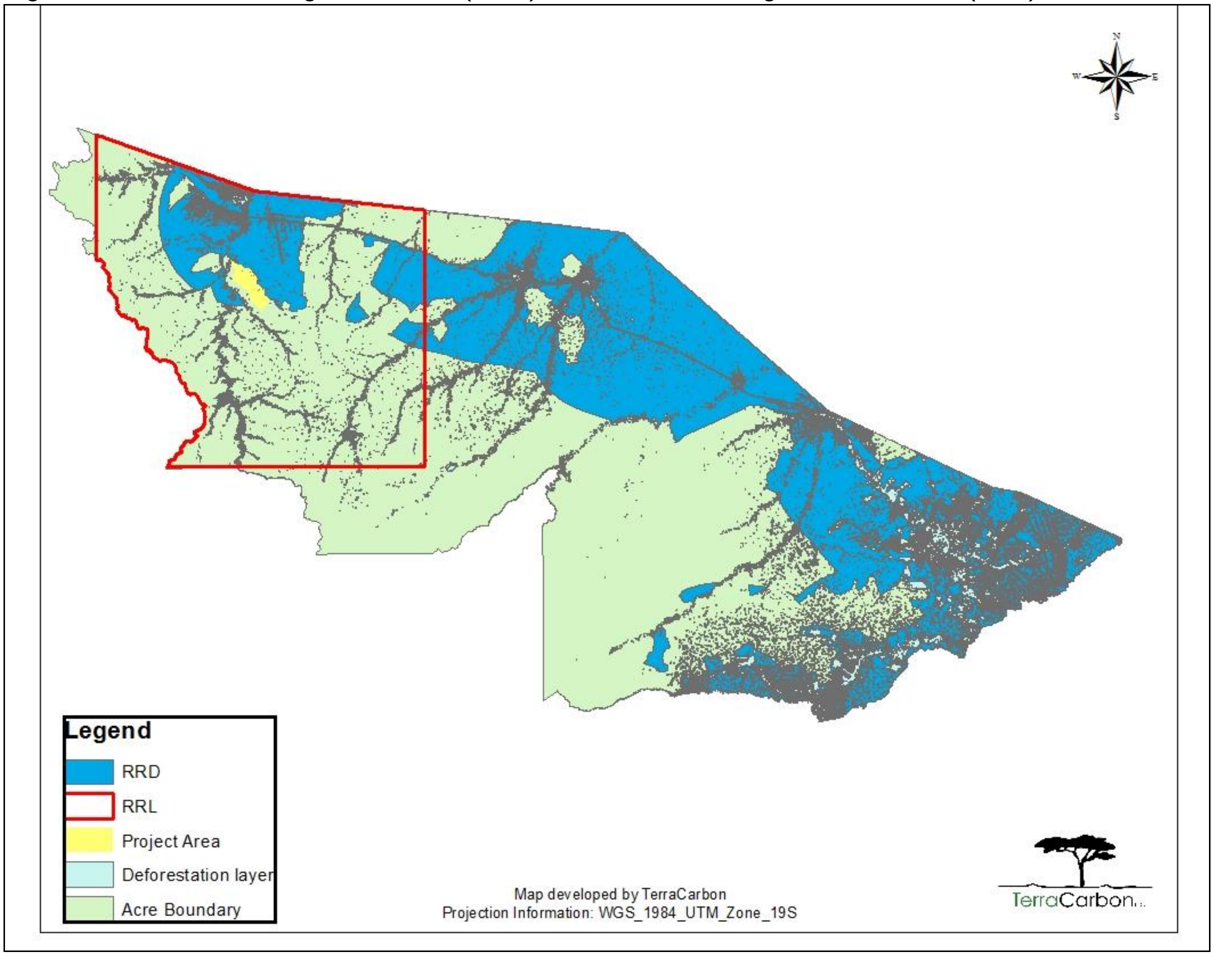
Table 3.1. Criteria for defining the boundary of the RRD and leakage belt.

Factors Assessed	Category	RRD	Project Area	Leakage Belt
Vegetation (%)				
	Open Forest	82.4%	99.5%	100.0%
	Dense Forest	6.3%	0.0%	0.0%
	Other	11.3%	0.5%	0.0%
Elevation (%)				
	0-500m	100.0%	100.0%	100.0%
Slope (%)				
	Gentle (<15%)	98.3%	99.8%	99.5%
	Steep (>15%)	1.7%	0.2%	0.5%
Soil (%)				
	GLEISSOLO	6.3%	30.2%	43.3%
	ARGISSOLO	35.8%	69.1%	40.9%
	PLINTOSSOLO	5.0%	0.0%	7.2%
	LATOSSOLO	5.3%	0.0%	0.0%
	ESPELHO D'Agua	0.2%	0.1%	1.1%
	VERTISSOLO	2.2%	0.0%	0.0%
	LUVISSOLO	14.0%	0.0%	0.0%
	NEOSSOLO	2.0%	0.6%	0.0%
	CAMBISSOLO	29.2%	0.0%	7.5%
Rivers (m/km^2)				
		95	146.8	124.6
Roads (m/km^2)				
		0	0	0
Settlements (Number/km^2)				
		0.0181	0.0048	0.0431

Reference Region for Projecting Location of Deforestation

The reference region for projecting location of deforestation (RRL) is delineated as shown in Figure 3.1. The entire RRL is located within Acre state and has an area of 4,552,510 hectares. In agreement with the methodology, it is a single parcel, contiguous with and including the project area and the leakage belt. Further, it is 5.3% non-forest and 94.7% forest and thus in compliance with the methodological requirements of a minimum of 5% non-forest and a minimum of 50% forest. The forest area of the RRL totals 4,313,542 ha which is within the ±25% of the size of the RRD.

Figure 3.1. Reference Region for Rate (RRD) and Reference Region for Location (RRL).



Project Area

The project area (see Figure 3.2, below) consists of one parcel along the southern bank of the Valparaiso River (see Section 1.9) which is under threat of deforestation. The project proponents are undertaking project activities, outlined in Section 1.8, in and around the project area to mitigate deforestation pressures and stop deforestation. The total project area is 41,976 hectares and was 100% forested at the start of the project.

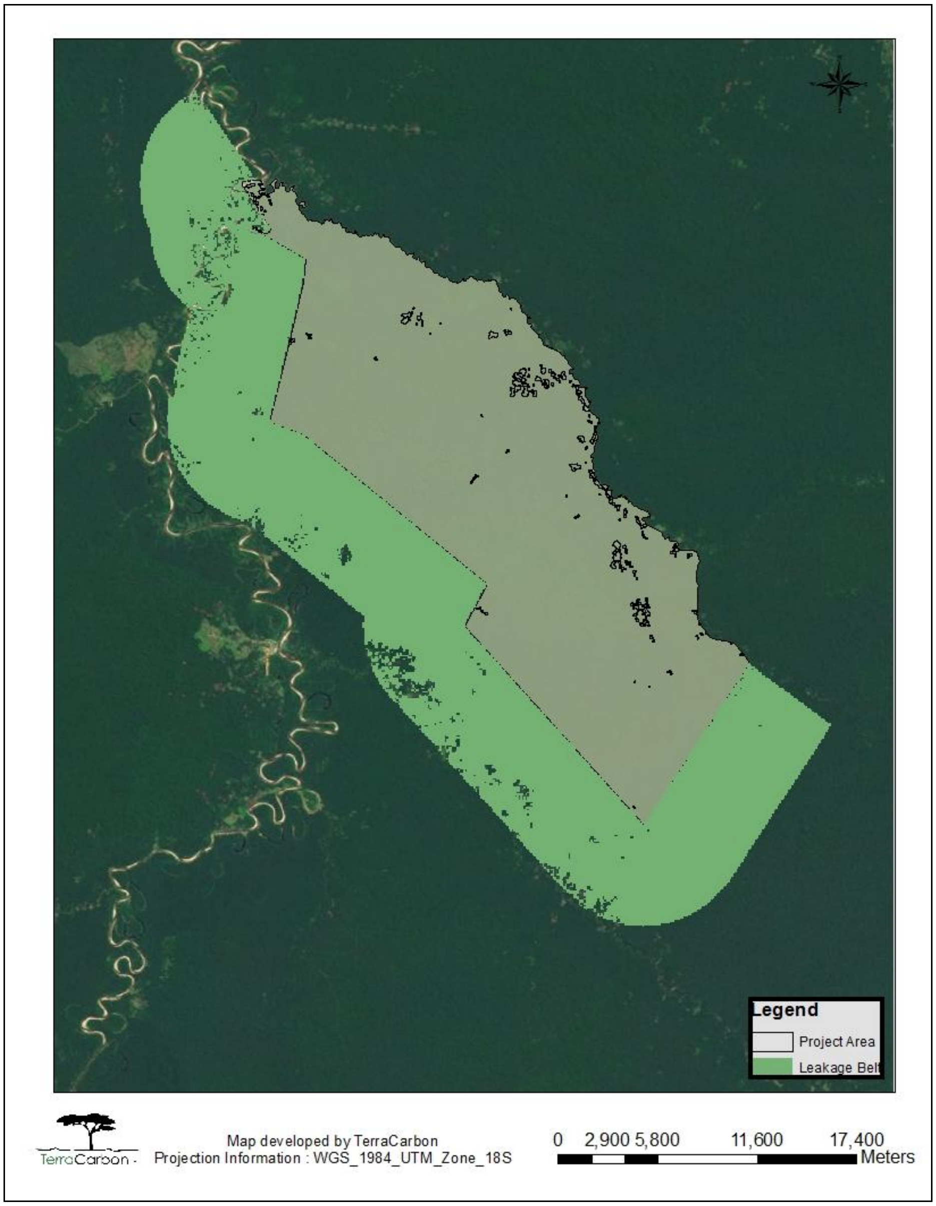
Leakage Belt

The leakage belt (see Figure 3.2, below) is the area surrounding or in the immediate vicinity of the project area where leakage caused by activity displacement is expected to occur. It meets the following requirements as outlined in the methodology:

- It is the forest area closest to the project area and meets the minimum area requirement (i.e., ≥90% of project area). The leakage belt covers 41,134 hectares which is 97.8% of the project area.
- All parts of the leakage belt are accessible and reachable by agents of deforestation.

- The leakage belt is not spatially biased in terms of distance of edge of belt from edge of project area; however the belt is only to the south of the project area as the area to the north is another VCS REDD project, the Valparaiso Project, and the leakage belt of that project.
- The leakage belt is 100% forest at the start of the project.

Figure 3.2. Russas Project Area and Leakage Belt Demonstrating Exclusion of Historically Deforested Areas.



3.1.1.2 Temporal Boundaries

The temporal boundaries of the Russas Project are listed below.

- January 1, 1996 to December 31, 2010 - Start date and end date of the historical reference period.
- March 17, 2011 to March 16, 2021 - Start date and end date of the first project baseline period.
- March 17, 2021 - Date at which the project baseline will be revisited. The baseline must be renewed every 10 years from the project start date.

3.1.2. Estimation of Annual Areas of Unplanned Deforestation

The rate of deforestation was derived from an analysis of deforestation occurring within the RRD during the historical reference period, 1996-2010.

3.1.2.1 Analysis of Historical Deforestation

UCEGEO, the Central Unit of GIS and Remote Sensing within the Climate Change Institute (IMC) in Acre, 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 with 2012 as the most recent year for which data has been released. While the pixel resolution of 30m x 30m is maintained in the Landsat based dataset, the smallest mapping unit for deforestation is 1 hectare which is in agreement with the Brazilian definition of a forest[44] as set by the Clean Development Mechanism Designated National Authority.

A deforestation map layer at the level of the state is produced annually by UCEGEO. Deforestation maps are cumulative with new annual deforestation data added each year. Therefore the 2011 forest/nonforest map was produced by performing a union of the outline of the state and all mapped deforestation area up to and including deforestation occurring in the year 2011. New deforestation included in the annual statewide deforestation map produced by UCEGEO include new deforestation detected within the calendar year (i.e., Landsat scenes are mosaicked from various months within a calendar year to produce a single image with minimal cloud cover).

An accuracy assessment of the 2011 forest/nonforest map was performed using 100 randomly distributed ground truth points per class for a total of 200 ground truthing points derived from high-resolution imagery in Google Earth (e.g. Quickbird). The Quickbird satellite collects multispectral imagery at 2.4 and 2.8 meter resolutions, thus meets the requirements of the methodology of < 5m resolution for ground truthing imagery. All ground truthing sample points used to assess classification accuracy have been documented in a kml file and archived. Samples used to assess classification accuracy are distributed throughout the classification area (as far as is possible considering availability of high resolution imagery and/or logistics of acquiring ground truth data). All verification samples gathered from high-resolution imagery were from within 12 months of the classification year. Points were then compared to the forest/non-forest classification for 2011. The accuracy of the 2011 forest/non-forest map was 99% for both the forest and

[44] 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.

non-forest class[45]. This meets the minimum map accuracy of 90% for each class as set forth in the methodology.

3.1.2.2 Estimation of the Annual Areas of Unplanned Baseline Deforestation in the RRD

Annual estimates of deforestation within the RRD were derived by calculating the amount of all deforestation within the boundary of the RRD from the GIS layer of deforestation from 1996-2010 (which already has all the deforestation prior to 1996 removed, see Figure 3.1). The result was the amount of deforestation within the RRD in the historical reference period. This was then summarized by year yielding the results found in Table 3.2.

Table 3.2. Annual Amount of Deforestation in the RRD.

Year	Area of deforestation in RRD (ha)
1996	95,661
1997	46,387
1998	45,612
1999	74,478
2000	43,429
2001	52,524
2002	80,099
2003	70,625
2004	67,365
2005	70,624
2006	42,930
2007	46,216
2008	27,522
2009	31,794
2010	59,670
Average	56,996

As neither linear or nonlinear regressions resulted in a model with an $r^2 > 0.25$, the mean area deforested across the historical reference period (ABSL,RRD,unplanned,t), located above in Table 3.2, is used for each year in the baseline period.

ABSL,RRD,unplanned,t = 56,996 ha

3.1.2.3 Estimation of Annual Areas of Unplanned Baseline Deforestation in the Project Area

The projected amount of unplanned baseline deforestation in the RRL is estimated using Equation 3.1.

Equation 3.1. Equation to calculate projected area of deforestation in the RRL.

$$\boxed{A_{BSL,RR,unplanned,t} = A_{BSL,RRD,unplanned,t} * P_{RRL}}$$

[45] More detailed results of the accuracy assessment can be found in the project database.

Table 3.3 Projected Area of Unplanned Baseline Deforestation in the RRL.

Parameter	Description	Value	Justification
ABSL,RR,unplanned,t	Projected area of unplanned baseline deforestation in the reference region for location (RRL) in year t; ha	46,580	
ABSL,RRD,unplanned,t	Projected area of unplanned baseline deforestation in RRD in year t; ha	56,996	Derived in Section 3.1.2.2
PRRL	Ratio of forest area in the RRL at the start of the baseline period to the total area of the RRD; dimensionless	0.817	RRL forested area = 4,444,846 ha RRD area = 5,438,719 ha

ABSL,RR,unplanned,t = 46,580 ha per year

3.1.3. Location and Quantification of Threat of Unplanned Deforestation

Spatial analysis was conducted with the IDRISI SELVA software (Eastman 2011), and the Land Change Modeler (LCM) which is an integrated software environment. LCM is a spatially-explicit modeling tool that was used to model the location of deforestation projected in the baseline for both the project area and leakage belt. LCM was developed by Clark Labs in conjunction with the Andes Center of Biodiversity Conservation of Conservation International, and has been tested extensively in the South America (Clark labs 2007). LCM provides a wide range of tools organized in a series of steps for analyzing land cover change; modeling potential for change; predicting change and validating results. For this analysis, LCM was used to produce a vulnerability map of the project area and leakage belt. Translation of the vulnerability map into a scenario map of deforestation through the project term was conducted with a rank and assign operation. This model meets the criteria of (1) being peer-reviewed, (2) transparent, (3) incorporating spatial datasets used to explain patterns of deforestation, and (4) is capable of projecting the location of future deforestation (Kim 2010, Sangermano et al., 2010, Eastman et al., 2005).[46]

All spatial modeling analysis is performed on the reference region for projecting location of deforestation (RRL). The RRL is defined in section 3.1.1 and encompasses the area surrounding the project area and leakage belt (see Figure 3.1). Information from the reference region is analyzed under a spatially explicit modeling framework to construct future scenarios of how deforestation can be allocated in the reference

[46] Kim, O S. 2010. An Assessment of Deforestation Models for Reducing Emissions from Deforestation and Forest Degradation (REDD). *Transactions in GIS*. 14(5): 631-654.
Eastman J R, Van Fossen M E, and Solorzano L A 2005 Transition potential modeling for land cover change. In Maguire D J, Batty, and Goodchild M F (eds), GIS, *Spatial Analysis and Modeling*. Redlands CA, ESRI Press: 357–86.
Sangermano,F. Eastman, J R, and Zhu, V. 2010. Similarity Weighted Instance-based Learning for the Generation of TransitionPotentials in Land Use Change Modeling. *Transactions in GIS*. 14(5): 569–580.f

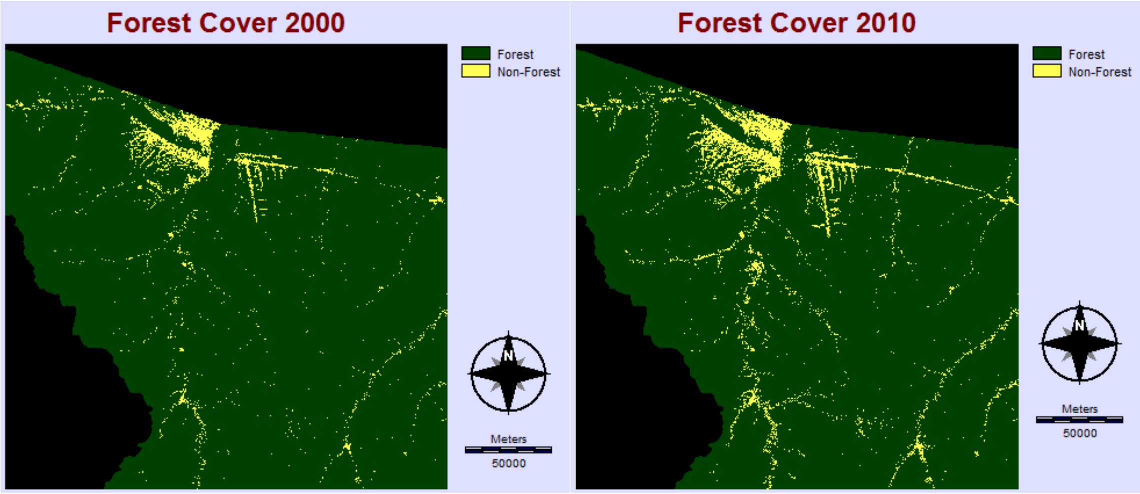
region. In conformance with the VCS modular REDD methodology VM0007, location analysis was conducted since the initial configuration of the RRL landscape was a frontier configuration.

3.1.3.1 Preparation of Datasets for Spatial Analysis

Land Cover Maps used for Model Calibration

Land cover maps from 2000, 2005 and 2010 (Figure 3.3) along with GIS coverages of spatial driver variables were analyzed with LCM to produce >50 different candidate vulnerability maps using different combinations of drivers.

Figure 3.3. Land cover maps for 2000 and 2010 used in spatial analysis (2005 not shown).



Land cover change modeling requires two phases; calibration and validation. The first time step, 2000-2005 was used to calibrate the model and the second time step 2005-2010 was used to validate the model's predictive capacity. For calibration, the classified maps from the first two time points (2000 and 2005) were analyzed. Locations that experienced a transition from forest to non-forest ("transition") and locations that do not transition but remained as forest ("persistence") were used to develop and test for relationships with potential driver variables. A large number of training sample locations was randomly chosen from both of these categories. This number may be user-defined, and in this model was set to 5,000 samples. An equal number of randomly selected locations were used to test the predictive capacity of the model within the calibration phase, and inform the adjustment of the weights of the input variables.

Developing a predictive model is an iterative process that requires exploration of the spatial variables that may drive deforestation patterns. Variables that have demonstrated strong correlation with deforestation in the field of land change science are categorized in the methodology into four categories: landscape factors, accessibility factors, anthropogenic factors, actual land tenure and management. All variables must be spatially explicit, and for use in the model must be in raster format. Spatial variable used in the model are called factor maps

Potential drivers of deforestation were assessed with input from regional experts, literature review and input from other land change modeling efforts. Assessment of factors that should be included in the model is an iterative process that is done by assessing multiple model runs while removing and adding variables selectively. Performance assessment of the combination of factor maps and their predictive capacity is done at multiple stages of the analysis. This results in a general assessment of the models accuracy, and can be used to evaluate if factors have increased or decreased the models performance. Commonly used transformations for variables were also explored. Although transformations are only required for logistic regression modeling, where variables must be linearly related to the potential for transition, transformations can improve the performance of other models, especially where there may be strong non-linearities, thus yielding higher accuracy. Distance based variables were tested to see if transformations improved model accuracy. These transformations included the natural log transformation (ln) which is commonly effective in linearizing distance decay variables, a square root transformation, which can assist in enhancing the importance of small changes in distance, and categorization of distances into classes, which can help to tease out the critical zones of distance-related functions. Factor maps explored in the modeling and included in the final model are listed in Table 3.4.

Table 3.4. Factor Maps that were Incorporated in the Final Spatial Model.

Factors Considered	Description	Relative Contribution to Model Performance	Included in Final Model
Accessibility Factors	Distance to Roads	High	Yes
	Distance to River	High	Yes
Anthropogenic Factors	Distance to Deforestation	Highest	Yes
	Distance to Towns	Low	No
	Distance to Forest Edge	Low	No
Landscape Factors	Elevation	High	Yes
	Slope	Low	No
	Soil	Low	No
	Vegetation	Low	No
Actual Land Tenure & Management	Distance to Protected Areas	High	Yes
	Distance to Indigenous Areas	Low	No

3.1.3.2 Preparation of Risk Maps for Deforestation

Validation of the model is done by comparing the predicted change to actual change for the period from 2006 to 2010. The output of the model is a transition potential map or a "risk map" that expresses the likelihood or potential for a location to transition from forest to deforested on a scale from 0 (minimum potential) to 1 (maximum potential). These values can be ranked in descending order, and this map is used to assign pixels to deforestation.

Quantity of deforestation was estimated in a separate analysis detailed above using average historic rate of deforestation in the RRD. Areas of deforestation were allocated until the quantity of deforestation modeled was exhausted. The procedure was carried out for each year in the baseline, 2012-2021.

3.1.3.3 Selection of the Most Accurate Deforestation Risk Map

An artificial neural network was used to develop the risk maps, and the following procedures were followed to meet the requirements of model calibration and confirmation form the methodology:

For the calibration period, a minimum of 5,000 samples (pixels) of the "transition" category (forest to non-forest) and 5,000 samples (pixels) of the "persistence" category (locations that do not transition but remain as forest) were randomly selected and used for training and testing. A minimum of 10,000 iterations of the model were run before selecting the best fit model.

Using the above process, multiple risk maps and the corresponding prediction maps were created for the year 2010. Each prediction map is compared to the actual map from 2010 to assess the model's performance. The measure of performance used as mandated by the methodology is the "Figure of Merit" (FOM) that confirms the model prediction in statistical manner (Pontius et al. 2008[47]; Pontius et al. 2007[48]). The FOM is a ratio of the intersection of the observed change (change between the reference maps in time 1 and time 2) and the predicted change (change between the reference map in time 1 and simulated map in time 2) to the union of the observed change and the predicted change. The FOM ranges from 0%, where there is no overlap between observed and predicted change, to 100% where there is a perfect overlap between observed and predicted change. The highest percent FOM and least number of factor maps used for creating the deforestation risk map must be used as the criteria for selecting the most accurate deforestation risk map to be used for predicting future deforestation.

Equation 3.2. Equation to Determine the "Figure of Merit".

$$\boxed{FOM = \frac{CORRECT}{CORRECT + Err_A + Err_B}}$$

Where,

CORRECT Area correct due to observed change predicted as change; ha

ErrA Area of error due to observed change predicted as persistence; ha

ErrB Area of error due to observed persistence predicted as change; ha

The final model was selected from multiple runs, according to the methodology as having the highest FOM value with the fewest number of factor maps with a minimum of one factor map in each of the 4 categories defined.

FOM = 23,114 ha/(23,114 ha + 23,988 ha + 209,788) = 0.089976

%FOM = 9.0%

The minimum threshold for the best fit as measured by the Figure of Merit (FOM) is defined by the net observed change in the reference region for the calibration period of the model (2000-2005). Net observed change is calculated as the total area of change being modeled in reference region during the calibration period as percentage of the total area of the reference region. Net change from 2000-2005

[47] R G Pontius Jr, W Boersma, J-C Castella, K Clarke, T de Nijs, C Dietzel, Z Duan, E Fotsing, N Goldstein, K Kok, E Koomen, C D Lippitt, W McConnell, A Mohd Sood, B Pijanowski, S Pithadia, S Sweeney, T N Trung, A T Veldkamp, and P H Verburg. 2008. Comparing input, output, and validation maps for several models of land change. Annals of Regional Science, 42(1): 11-47.

[48] R G Pontius Jr, R Walker, R Yao-Kumah, E Arima, S Aldrich, M Caldas and D Vergara. 2007. Accuracy assessment for a simulation model of Amazonian deforestation. Annals of Association of American Geographers, 97(4): 677-695.)

was 46,788 hectares out of a total of 4,552,510, which is 1.03% of total area. The FOM value therefore exceeds the minimum threshold.

3.1.3.4 Mapping of the Locations of Future Deforestation

From the model, a future deforestation risk map was created to assign a likelihood of deforestation to each pixel. Using a rank operation, all forested pixels of the RRL were ranked in descending order, so that the pixel with the highest likelihood of deforestation was assigned a value of 1. Future deforestation was assumed to happen first at the pixel locations with the highest deforestation risk value, so each pixel was allocated to deforestation in rank order for each year according to the annual projections from 2012-2021 ($A_{BSL,RR,unplanned,t}$). This operation resulted in a single map showing the predicted deforestation over the baseline period (Figure 3.4) in the project area and surrounding reference region. Further, the area of baseline deforestation for the project area and leakage belt was summed by strata for each year in the baseline period (Table 3.5 and Table 3.6).

Figure 3.4. Map of the Predicted Deforestation in the Baseline Period, 2012-2021.

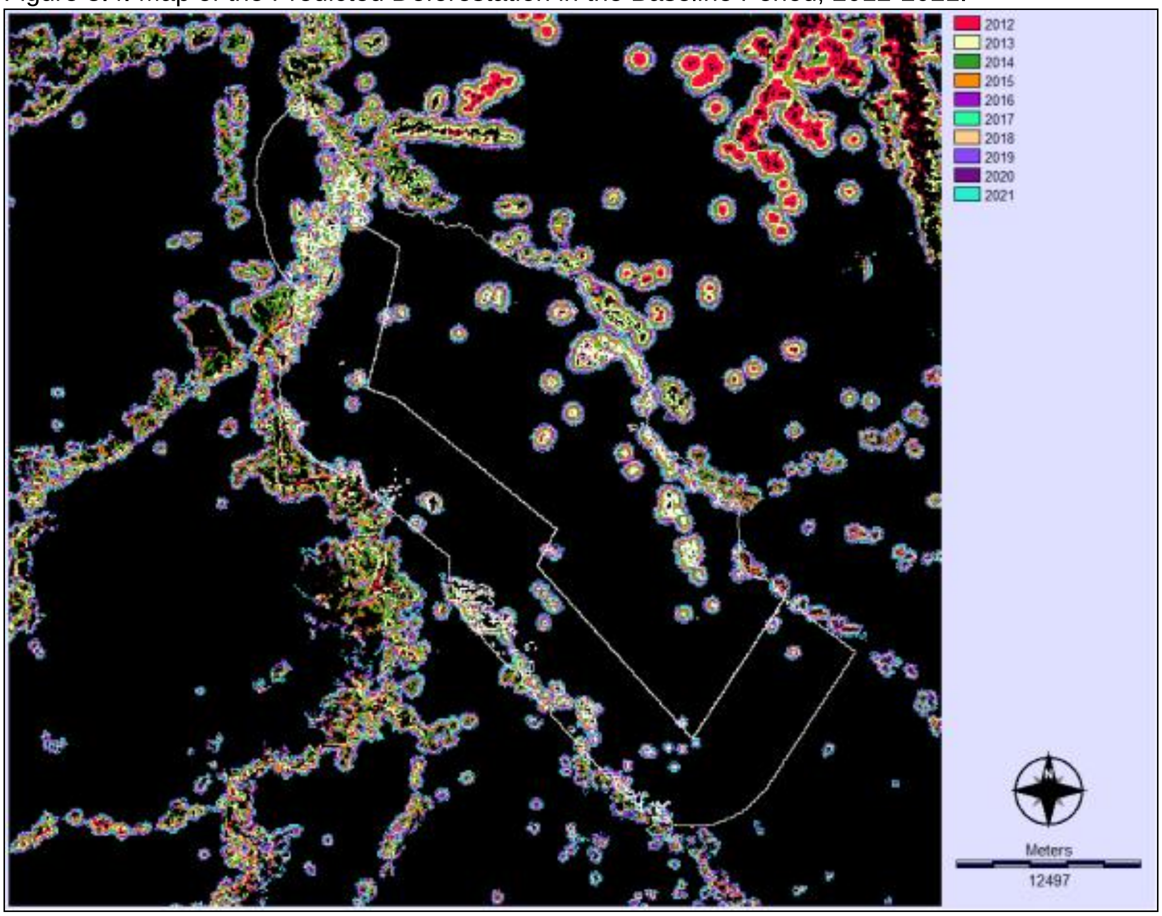


Table 3.5. Amount of Baseline Deforestation (ha) in the Project Area.

Year	Aunplanned,i,t, FAB + FAP (ha)	AAunplanned,i,t, FAP (ha)	AAunplanned,i,t, FAP-alluvial (ha)	AAunplanned,i,t, FAP + FAB + FD or FAP + FD + FAB (ha)	AAunplanned,i,t, FAP + FD or FD + FAP (ha)	Total (ha)
2012	3.0	19.0	6.0	0.0	106.0	134.0
2013	54.0	162.0	130.0	0.0	359.0	705.0
2014	50.0	239.0	197.0	0.0	330.0	816.0
2015	40.0	232.0	189.0	8.0	279.0	748.0
2016	37.0	243.0	177.0	6.0	301.0	764.0
2017	35.0	207.0	143.0	3.0	251.0	639.0
2018	27.0	243.0	131.0	4.0	309.0	714.0
2019	41.0	240.0	142.0	6.0	310.0	739.0
2020	34.0	211.0	97.0	3.0	258.0	603.0
2021	37.0	255.0	124.0	3.0	301.0	720.0
Total	358.0	2,051.0	1,336.0	33.0	2,804.0	6,582.0

Table 3.6. Amount of Baseline Deforestation (ha) in the Leakage Belt.

Year	Aunplanned,i,t, FAB + FAP (ha)	AAunplanned,i,t, FAP (ha)	AAunplanned,i,t, FAP-alluvial (ha)	AAunplanned,i,t, FAP + FAB + FD or FAP + FD + FAB (ha)	AAunplanned,i,t, FAP + FD or FD + FAP (ha)	Total (ha)
2012	25.0	2.0	12.0	24.0	1.0	64.0
2013	392.0	12.0	189.0	45.0	14.0	652.0
2014	496.0	51.0	405.0	51.0	60.0	1063.0
2015	285.0	61.0	434.0	20.0	108.0	908.0
2016	186.0	84.0	405.0	14.0	196.0	885.0
2017	137.0	84.0	351.0	8.0	197.0	777.0
2018	127.0	91.0	391.0	2.0	253.0	864.0
2019	129.0	127.0	373.0	6.0	237.0	872.0
2020	102.0	94.0	277.0	1.0	217.0	691.0
2021	140.0	159.0	301.0	2.0	264.0	866.0
Total	2,019.0	765.0	3,138.0	173.0	1,547.0	7,642.0

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.[49] The forest types present in the Russas Project area include: open forest with bamboo and palm (FAB + FAP), open palm forest (FAP), open alluvial forest with palm (FAP - Alluvial), open forest with bamboo and palm and dense forest (FAP + FAB + FD and FAP + FD + FAB), and dense forest and

[49] 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.

open palm forest (FAP + FD and FD + FAP). One further stratum not present in the project area, open alluvial forest with bamboo (FAB - Alluvial), represented a very small area of the leakage belt. A map of the vegetation strata in the project area and leakage belt can be found in Figure 1.9.

Table 3.7. Areas of Strata within the Project Area.

Stratum	Stratum Description	Area (hectares)
FAB + FAP	Open forest with bamboo and palm	9,792
FAP	Open palm forest	11,863
FAP – Alluvial	Open alluvial forest with palm	3,012
FAP + FAB + FD and FAP + FD + FAB	Open forest with bamboo and palm and dense forest	56
FAP + FD and FD + FAP	Dense forest and open palm forest	17,217

Table 3.8. Areas of Strata within the Leakage Belt.

Stratum	Stratum Description	Area (hectares)
FAB + FAP	Open forest with bamboo and palm	6,955
FAP	Open palm forest	11,423
FAP – Alluvial	Open alluvial forest with palm	8,981
FAB – Alluvial	Open alluvial forest with bamboo	173
FAP + FD and FD + FAP	Dense forest and open palm forest	13,602

3.1.4.2 Estimation of Carbon Stocks and Carbon Stock Changes per Stratum

Forest carbon stocks were directly measured in a forest inventory of the Russas Project area in 2013. Results are detailed in the "Forest biomass carbon inventory for the Russas and Valparaiso Properties, Acre State, Brazil" 2013 which can be found in the project database. The stock estimate for the FAB-Alluvial strata referenced data from Salimon et al.[1] Results are summarized by forest strata in the tables below.

Equation 3.3. Equation to Calculate Carbon Stocks in all Carbon Pools in Each Forest Stratum.

$$C_{BSL,i} = C_{AB\_tree,i} + C_{BB\_tree,i} + C_{AB\_non-tree,i} + C_{BB\_non-tree,i} + C_{DW,i} + C_{LI,i} + C_{SOC,i}$$

Table 3.9a. Estimation of Carbon Stocks for Stratum FAB + FAP.

Parameter	Description	Value	Justification
CBSL,i	Carbon stock in all carbon pools in forest stratum i; t CO_2e ha-1	452.6 t CO_2e ha-1	See forest inventory for calculations.
CAB_tree,i	Carbon stock in aboveground tree biomass in stratum i; t CO_2e ha-1	See forest inventory report for calculations.	
CBB_tree,i	Carbon stock in belowground tree biomass in stratum i; t CO_2e ha-1	See forest inventory report for calculations	

CDW,i	Carbon stock in dead wood in stratum i; t CO_2e ha-1	See forest inventory report for calculations	

Table 3.9b. Estimation of Carbon Stocks for Stratum FAP.

Parameter	**Description**	**Value**	**Justification**
CBSL,i	Carbon stock in all carbon pools in forest stratum i; t CO_2e ha-1	460.8 t CO_2e ha-1	See forest inventory for calculations.
CAB_tree,i	Carbon stock in aboveground tree biomass in stratum i; t CO_2e ha-1	See forest inventory report for calculations.	
CBB_tree,i	Carbon stock in belowground tree biomass in stratum i; t CO_2e ha-1	See forest inventory report for calculations	
CDW,i	Carbon stock in dead wood in stratum i; t CO_2e ha-1	See forest inventory report for calculations	

Table 3.9c. Estimation of Carbon Stocks for Stratum FAP – Alluvial.

Parameter	**Description**	**Value**	**Justification**
CBSL,i	Carbon stock in all carbon pools in forest stratum i; t CO_2e ha-1	372.9 t CO_2e ha-1	See forest inventory for calculations.
CAB_tree,i	Carbon stock in aboveground tree biomass in stratum i; t CO_2e ha-1	See forest inventory report for calculations.	
CBB_tree,i	Carbon stock in belowground tree biomass in stratum i; t CO_2e ha-1	See forest inventory report for calculations	
CDW,i	Carbon stock in dead wood in stratum i; t CO_2e ha-1	See forest inventory report for calculations	

Table 3.9d. Estimation of Carbon Stocks for Stratum FAP + FAB + FD and FAP + FD + FAB.

Parameter	**Description**	**Value**	**Justification**
CBSL,i	Carbon stock in all carbon pools in forest stratum i; t CO_2e ha-1	487.0 t CO_2e ha-1	See forest inventory for calculations.
CAB_tree,i	Carbon stock in aboveground tree biomass in stratum i; t CO_2e ha-1	See forest inventory report for calculations.	

CBB_tree,i	Carbon stock in belowground tree biomass in stratum i; t CO_2e ha-1	See forest inventory report for calculations	
CDW,i	Carbon stock in dead wood in stratum i; t CO_2e ha-1	See forest inventory report for calculations	

Table 3.9e. Estimation of Carbon Stocks for Stratum FAP + FD and FD + FAP.

Parameter	**Description**	**Value**	**Justification**
CBSL,i	Carbon stock in all carbon pools in forest stratum i; t CO_2e ha-1	393.3 t CO_2e ha-1	See forest inventory for calculations.
CAB_tree,i	Carbon stock in aboveground tree biomass in stratum i; t CO_2e ha-1	See forest inventory report for calculations.	
CBB_tree,i	Carbon stock in belowground tree biomass in stratum i; t CO_2e ha-1	See forest inventory report for calculations	
CDW,i	Carbon stock in dead wood in stratum i; t CO_2e ha-1	See forest inventory report for calculations	

Table 3.9f. Estimation of Carbon Stocks for Stratum FAB – Alluvial.

Parameter	**Description**	**Value**	**Justification**
CBSL,i	Carbon stock in all carbon pools in forest stratum i; t CO_2e ha-1	CBSL,I = 424.4 t CO_2e ha-1	
CAB_tree,i	Carbon stock in aboveground tree biomass in stratum i; t CO_2e ha-1	CAB_tree,I = 332.3 t CO_2e ha-1	Used 2011 estimate (110.1 t C/ha) from Salimon et al.[1] for this specific strata.
CBB_tree,i	Carbon stock in belowground tree biomass in stratum i; t CO_2e ha-1	CBB_tree,I = 75.9 t CO_2e ha-1	Estimate (24.8 t C/ha) derived from aboveground biomass using the Cairns et al.[2] equation, as carried out in the forest inventory.
CDW,i	Carbon stock in dead wood in stratum i; t CO_2e ha-1	CDW,I = 16.3 t CO_2e ha-1	Used estimate derived for the FAP-Alluvial strata in the forest inventory.

[1]Salimon et al. 2011. Estimating state-wide biomass carbon stocks for a REDD plan in Acre, Brazil. Forest Ecology and Management 262: 555-560.
[2]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.

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. Net emissions (CBSL -C post) from steady decomposition of these pools are elaborated in Tables 3.10 and 3.11, below.

Table 3.10a. 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)	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
2012	8,442	844	844	844	844	844	844	844	844	844	844
2013	45,273		4,527	4,527	4,527	4,527	4,527	4,527	4,527	4,527	4,527
2014	52,836			5,284	5,284	5,284	5,284	5,284	5,284	5,284	5,284
2015	48,661				4,866	4,866	4,866	4,866	4,866	4,866	4,866
2016	49,760					4,976	4,976	4,976	4,976	4,976	4,976
2017	41,684						4,168	4,168	4,168	4,168	4,168
2018	46,722							4,672	4,672	4,672	4,672
2019	48,331								4,833	4,833	4,833
2020	39,666									3,967	3,967
2021	47,338										4,734
Total		844	5,371	10,655	15,521	20,497	24,666	29,338	34,171	38,137	42,871

Table 3.10b. Emissions from steady decomposition of belowground biomass post deforestation in the leakage belt ($CBSL_{BB}$ -C $post_{BB}$, t CO2-e).

Year	BGB Emissions from Deforestation (t CO2)	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
2012	4,264	426	426	426	426	426	426	426	426	426	426
2013	43,082		4,308	4,308	4,308	4,308	4,308	4,308	4,308	4,308	4,308
2014	68,993			6,899	6,899	6,899	6,899	6,899	6,899	6,899	6,899
2015	57,559				5,756	5,756	5,756	5,756	5,756	5,756	5,756
2016	55,651					5,565	5,565	5,565	5,565	5,565	5,565
2017	48,755						4,875	4,875	4,875	4,875	4,875
2018	53,918							5,392	5,392	5,392	5,392
2019	54,978								5,498	5,498	5,498
2020	43,508									4,351	4,351
2021	55,316										5,532
Total		426	4,735	11,634	17,390	22,955	27,831	33,222	38,720	43,071	48,603

Table 3.11a. Emissions from steady decomposition of dead wood post deforestation in the project area, ($CBSL_{DW}$ -C $post_{DW,}$ t CO2-e).

Year	BGB Emissions from Deforestation (t CO2)	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
2012	2,591	259	259	259	259	259	259	259	259	259	259
2013	13,056		1,306	1,306	1,306	1,306	1,306	1,306	1,306	1,306	1,306
2014	14,390			1,439	1,439	1,439	1,439	1,439	1,439	1,439	1,439
2015	12,988				1,299	1,299	1,299	1,299	1,299	1,299	1,299
2016	13,254					1,325	1,325	1,325	1,325	1,325	1,325
2017	11,115						1,111	1,111	1,111	1,111	1,111
2018	12,337							1,234	1,234	1,234	1,234
2019	12,948								1,295	1,295	1,295
2020	10,529									1,053	1,053
2021	12,482										1,248
Total		259	1,565	3,004	4,303	5,628	6,739	7,973	9,268	10,321	11,569

Table 3.11b. Emissions from steady decomposition of dead wood post deforestation in the leakage belt ($CBSL_{DW}$ -C $post_{DW,}$ t CO2-e).

Year	BGB Emissions from Deforestation (t CO2)	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
2012	1,364	136	136	136	136	136	136	136	136	136	136
2013	15,735		1,573	1,573	1,573	1,573	1,573	1,573	1,573	1,573	1,573
2014	23,823			2,382	2,382	2,382	2,382	2,382	2,382	2,382	2,382
2015	18,714				1,871	1,871	1,871	1,871	1,871	1,871	1,871
2016	17,329					1,733	1,733	1,733	1,733	1,733	1,733
2017	14,936						1,494	1,494	1,494	1,494	1,494
2018	16,430							1,643	1,643	1,643	1,643
2019	16,379								1,638	1,638	1,638
2020	13,124									1,312	1,312
2021	16,412										1,641
Total		136	1,710	4,092	5,964	7,696	9,190	10,833	12,471	13,783	15,425

3.1.4.3 Estimation of the Sum of Baseline Carbon Stock Changes

The sum of baseline carbon stock changes (ΔCTOT) was estimated using Equation 3.4. Parameters for use of Equation 3.4 can be found in Table 3.12. One of the parameters, the total forest carbon stock in areas deforested (CBSL), was calculated as per Equation 3.5. ΔCTOT and CBSL are calculated in Table 3.14 for the project area and 3.15 for the leakage belt.

Equation 3.4. Equation to Calculate the Sum of the Baseline Carbon Stock Change in all Pools up to Time t

$$\Delta C_{TOT} = C_{BSL} - C_{post} - C_{wp}$$

Table 3.12. Estimation of Sum of Baseline Carbon Stock Changes in the Project Area and Leakage Belt.

Parameter	Description	Value	Justification
ΔCTOT	Sum of the baseline carbon stock change in all pools up to time t*; t CO_2e	See calculations below.	
CBSL	Total forest carbon stock in areas deforested; t CO_2e	See calculations below.	See calculations below.
C post	Total post-deforestation carbon stock in areas deforested; t CO_2e	See calculations below.	Option 2, Historical area-weighted average approach. Value of 40.4 t CO_2/ha The historical area-weighted average approach uses land use data provided by the State of Acre[50] and information on biomass stocks from a local study by Salimon et al.[51] entitled “Estimating state-wide biomass carbon stocks for a REDD plan in Acre, Brazil”. The study by the State of Acre indicated that 81% of the deforested Areas in the state were covered to pasture, 6% used for agriculture, and 13% were in some early stage of secondary

[50] 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.
[51] Salimon et al. 2011. Estimating state-wide biomass carbon stocks for a REDD plan in Acre, Brazil. Forest Ecology and Management 262: 555-560.

			succession. Salimon et al. lists biomass values for pasture (16.0 tons d.m./ha), agriculture (11.6 tons d.m./ha) and secondary forest cropland (37.0 tons d.m./ha). These values were converted to the total aboveground and belowground biomass stock applying the allometric root equation developed by Cairns et al.[52]. After converting to t CO_2/ha, an area weighted average of 40.4 t CO_2/ha was calculated. See the project database for details of the analysis.
C wp	Total carbon stock in harvested wood products; t CO_2e	0	No commercial harvesting of wood products takes place in either the baseline or with project scenarios.

Equation 3.5. Equation to Calculate the Sum of the Baseline Carbon Stock Change in all Pools up to Time t

$$C_{BSL} = \sum_{t=1}^{t*} \sum_{i=1}^{M} ((C_{BSL,i}) * A_{unplanned,i,t})$$

Table 3.13. Parameters used to calculate the total forest carbon stock in areas deforested.

Parameter	Description
CBSL	Total forest carbon stock in areas deforested; t CO2-e
CBSL,i	Carbon stock in all carbon pools in the forest stratum i; t CO2-e ha-1
Aunplanned,i,t	Area of unplanned deforestation in forest stratum i at time t; ha

[52] 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 3.14. Calculation of the Total Forest Carbon Stock in Areas Deforested (CBSL) and the Sum of the Baseline Carbon Stock Change in all Pools up to Time t (ΔCTOT) in the Project Area.

Year	Aunplanned, i,t, FAB + FAP (ha)	AAunplanned ,i,t, FAP (ha)	AAunplanned ,i,t, FAP-alluvial (ha)	AAunplanned ,i,t, FAP + FAB + FD or FAP + FD + FAB (ha)	AAunplanned ,i,t, FAP + FD or FD + FAP (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)	ΔCTOT (t CO2-e)
2012	3.0	19.0	6.0	0.0	106.0	41,856	4,261	844	259	0	38,698
2013	54.0	162.0	130.0	0.0	359.0	224,378	22,419	5,371	1,565	0	208,895
2014	50.0	239.0	197.0	0.0	330.0	261,778	25,949	10,655	3,004	0	249,489
2015	40.0	232.0	189.0	8.0	279.0	241,043	23,786	15,521	4,303	0	237,080
2016	37.0	243.0	177.0	6.0	301.0	246,457	24,295	20,497	5,628	0	248,286
2017	35.0	207.0	143.0	3.0	251.0	206,445	20,320	24,666	6,739	0	217,530
2018	27.0	243.0	131.0	4.0	309.0	231,333	22,705	29,338	7,973	0	245,939
2019	41.0	240.0	142.0	6.0	310.0	239,322	23,500	34,171	9,268	0	259,260
2020	34.0	211.0	97.0	3.0	258.0	196,349	19,175	38,137	10,321	0	225,632
2021	37.0	255.0	124.0	3.0	301.0	234,333	22,896	42,871	11,569	0	265,878
Total	358.0	2,051.0	1,336.0	33.0	2,804.0	2,123,295	209,308	222,072	60,629	0	2,196,688

Table 3.15. Calculation of the Total Forest Carbon Stock in Areas Deforested (CBSL) and the Sum of the Baseline Carbon Stock Change in all Pools up to Time t (ΔCTOT) in the Leakage Belt.

Year	Aunplanned, i,t, FAB + FAP (ha)	AAunplanned ,i,t, FAP (ha)	AAunplanned ,i,t, FAP-alluvial (ha)	AAunplanned ,i,t, FAP + FAB + FD or FAP + FD + FAB (ha)	AAunplanned ,i,t, FAP + FD or FD + FAP (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)	ΔCTOT (t CO2-e)
2012	25.0	2.0	12.0	24.0	1.0	21,112	2,035	426	136	0	19,640
2013	392.0	12.0	189.0	45.0	14.0	213,611	20,734	4,735	1,710	0	199,322
2014	496.0	51.0	405.0	51.0	60.0	342,305	33,803	11,634	4,092	0	324,228
2015	285.0	61.0	434.0	20.0	108.0	285,827	28,874	17,390	5,964	0	280,306
2016	186.0	84.0	405.0	14.0	196.0	276,360	28,143	22,955	7,696	0	278,868
2017	137.0	84.0	351.0	8.0	197.0	242,110	24,709	27,831	9,190	0	254,422
2018	127.0	91.0	391.0	2.0	253.0	267,799	27,475	33,222	10,833	0	284,379
2019	129.0	127.0	373.0	6.0	237.0	272,910	27,730	38,720	12,471	0	296,371
2020	102.0	94.0	277.0	1.0	217.0	215,976	21,974	43,071	13,783	0	250,856
2021	140.0	159.0	301.0	2.0	264.0	274,387	27,539	48,603	15,425	0	310,875
Total	2,019.0	765.0	3,138.0	173.0	1,547.0	2,412,396	243,016	248,586	81,300	0	2,499,267

3.1.4.4 Calculation of Net CO_2 Equivalent Emissions

Net CO_2 emissions in the baseline for the project area and leakage belt are calculated using Equation 3.6 below.

Equation 3.6. Equation to Calculate Net Greenhouse Gas Emissions in the Baseline from Unplanned Deforestation.

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

As GHG emissions in the baseline are excluded from the project boundary, the net CO_2 emissions in the baseline is equal to the sum of the baseline carbon stock change in all pools (ΔCBSL,unplanned = ΔCTOT).

ΔCBSL,PA,unplanned = 2,196,688 t CO_2e

ΔCBSL,LK,unplanned = 2,499,267 t CO_2e

3.2 Project Emissions

Expected project emissions are estimated ex-ante and apply Equation 3.7 of module M-MON (VMD0015) of Methodology VM0007. Values for individual parameters are justified in Table 3.16 or derived in Tables 3.17, Table 3.19, and Table 3.21. Ex-ante projections of deforestation unavoided in the project case assume project effectiveness of 80% (i.e., 20% of baseline deforestation occurs in the project case).

Equation 3.7. 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 3.16. 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 below for calculations.	
$\Delta C_{P,DefPA,i,t}$	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 below for calculations.	

$\Delta C_{P,Deg,i,t}$	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 (and degradation), have committed to no longer harvesting fuelwood and timber in forests surrounding their farms, and forest patrols with further deter degradation activities 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 below for calculations.	
$\Delta C_{P,Enh,i,t}$	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 3.17. Data used to Calculate $\Delta C_{P.}$

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)
2012	10,304	0	0	2	0	10,307
2013	54,213	0	0	13	0	54,226
2014	62,748	0	0	15	0	62,763
2015	57,519	0	0	14	0	57,533
2016	58,749	0	0	14	0	58,764
2017	49,137	0	0	12	0	49,149
2018	54,905	0	0	13	0	54,918
2019	56,827	0	0	14	0	56,841
2020	46,369	0	0	11	0	46,380
2021	55,366	0	0	13	0	55,379

Deforestation in the with Project Case

Equation 3.8, 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 3.18. 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 below for calculations.	See table below for calculations.
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 below for calculations.	See table below for calculations.
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 = 384.5	This value is the strata area weighted mean. See the forest inventory report for more information on the derivation of this value.

Table 3.19. 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)
2012	26.8	384.5	10,304
2013	141.0	384.5	54,213
2014	163.2	384.5	62,748
2015	149.6	384.5	57,519
2016	152.8	384.5	58,749
2017	127.8	384.5	49,137
2018	142.8	384.5	54,905
2019	147.8	384.5	56,827
2020	120.6	384.5	46,369
2021	144.0	384.5	55,366

ADefPA,u,i,t is derived assuming a project effectiveness of 80% (i.e., 20% of baseline deforestation occurs in the project case).

GHG Emissions

Greenhouse gas emissions as a result of deforestation activities within the project area (GHGP,E,i,t) are calculated in Table 3.21 using Equation 3.9. Parameters are found in Table 3.20 and Table 4.3.

Equation 3.9. 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^-3 * GWPg

Table 3.20. 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 below for calculations.	
EBiomassBurn,i,t	Non-CO_2 emissions due to biomass burning in stratum i in year t; t CO_2e	See table below for calculations.	Biomass burning is expected to occur in the with project case.

Table 3.21. Calculation of $E_{BiomassBurn,i,t..}$

Year	ADefPA,u,i,t (ha)	COMF	E-N2O Biomass Burning (tCO2e)	E-CH4 Biomass Burning (tCO2e)	E-Biomass Burning (tCO2e)	GHGP-E,i,t (t CO2-e)
2012	26.8	0.45	0.7	1.7	2.5	2.5
2013	141.0	0.45	3.9	9.1	13.0	13.0
2014	163.2	0.45	4.6	10.5	15.0	15.0
2015	149.6	0.45	4.2	9.6	13.8	13.8
2016	152.8	0.45	4.3	9.8	14.1	14.1
2017	127.8	0.45	3.6	8.2	11.8	11.8
2018	142.8	0.45	4.0	9.2	13.2	13.2
2019	147.8	0.45	4.1	9.5	13.6	13.6
2020	120.6	0.45	3.4	7.7	11.1	11.1
2021	144.0	0.45	4.0	9.3	13.3	13.3
Total	1,316.4		36.7	84.6	121.3	121.3

3.3 Leakage

Leakage emissions from displacement of unplanned deforestation are estimated in conformance with the VCS modular REDD methodology VM0007, specifically the LK-ASU module. This module provides for accounting for activity shifting leakage resulting from both local and immigrant deforestation agents.

Estimation of Baseline Carbon Stock Changes and Greenhouse Gas Emissions in the Leakage Belt

Activity shifting leakage due to displacement of unplanned deforestation was assessed using a baseline specific to the leakage belt developed following procedures detailed in the Module BL-UP. While details of the baseline are provided in Table 3.15, Table 3.22 below states the expected baseline estimates for the leakage belt.

Table 3.22. Estimation of Baseline Carbon Stock Changes and Greenhouse Gas Emissions in the Leakage Belt.

Year	ΔCTOT (t CO2-e)
2012	19,640
2013	199,322

2014	324,228
2015	280,306
2016	278,868
2017	254,422
2018	284,379
2019	296,371
2020	250,856
2021	310,875
Total	2,499,267

Estimation of the Proportions of Area Deforested by Immigrant and Local Deforestation Agents in the Baseline

From March to May 2012, 19 communities near the boundaries of the leakage belt and project area were surveyed. While the total number of communities in the area is not known, it is thought the maximum number is approximately 35 hence about 55% of communities in the area were sampled. Results of the community surveys indicated than only 1 of the 19 communities have migrated to the area within the last five years.

$PROP_{RES}$ = the proportion of area deforested by the population that has been resident in and around the leakage belt and project area for ≥ 5 years = 0.947; and

$PROP_{IMM}$ = the proportion of area deforested by population that has migrated into the area in the last 5 years = 0.053.

Estimation of Unplanned Deforestation Displaced from the Project Area to the Leakage Belt

Ex-ante baseline emissions occurring in the leakage belt are estimated by first estimating the amount of deforestation that is thought to be displaced from the project area to the leakage belt. As people living within the project area are well settled, there appears to be little risk of them displacing much of their activities to outside the project area given project implementation measures to improve agricultural productivity and secure land tenure, and therefore the leakage factor is estimated to be 0.15, or 15% of baseline emissions in the project area. Leakage is then calculated as the difference between project and baseline carbon stock changes and greenhouse gas emissions in the leakage belt, as outlined in Equation 3.10. Ex-ante estimates of the net CO_2 emissions due to unplanned deforestation displaced from the project area to the leakage belt are calculated for each year in the baseline period in Table 3.24.

Equation 3.10. Equation for Calculating Net CO_2 Emissions due to Unplanned Deforestation Displaced from the Project Area to the Leakage Belt.

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

Table 3.23. Parameters and Values used to Calculate Annual Ex-Ante GHG Emissions in the Leakage Belt.

Parameter	Description	Value	Justification
ΔCLK-ASU-LB	Net CO_2 emissions due to unplanned deforestation displaced from the project area to the leakage belt; t CO_2e	See Table 3.24.	Calculated.
ΔCBSL,LK,unplanned	Net CO_2 emissions in the baseline from unplanned deforestation in the leakage belt; t CO_2e	See Table 3.22.	Derived in Section 3.1.
ΔCP,LB	Net greenhouse gas emissions within the leakage belt in the project case t CO_2e	See Table 3.24.	Ex-ante estimate is calculated by multiplying the estimated baseline carbon stock changes and greenhouse gas emissions for the project area by a factor < 1.0 representing the % of deforestation expected to be displaced into the leakage belt. This result is then added to the estimated baseline for the leakage belt.

Table 3.24. Estimates of the Net CO_2 Emissions due to Unplanned Deforestation Displaced from the Project Area to the Leakage Belt.

Year	ΔCBSL,PA,unplanned (t CO2-e)	ΔCP,DefPA,i,t (t CO2-e)	Deforestation expected to be displaced from the project area	ΔCP,LB[1] (t CO2-e)	ΔCBSL,LK,unplanned (t CO2-e)	ΔCLK-ASU-LB (t CO2-e)
2012	38,698	10,304	4,259	23,899	19,640	4,259
2013	208,895	54,213	23,202	222,524	199,322	23,202
2014	249,489	62,748	28,011	352,239	324,228	28,011
2015	237,080	57,519	26,934	307,240	280,306	26,934
2016	248,286	58,749	28,431	307,299	278,868	28,431
2017	217,530	49,137	25,259	279,681	254,422	25,259
2018	245,939	54,905	28,655	313,034	284,379	28,655
2019	259,260	56,827	30,365	326,736	296,371	30,365
2020	225,632	46,369	26,889	277,746	250,856	26,889
2021	265,878	55,366	31,577	342,452	310,875	31,577
Total	2,196,688	506,137	253,583	2,752,850	2,499,267	253,583

Estimation of Unplanned Deforestation Displaced from the Project Area to Outside the Leakage Belt

Deforestation at the hands of immigrant agents outside the leakage belt is calculated in this section. The first step involves calculating the total available national forest area for unplanned deforestation, using Equation 3.11 and the values found in Table 3.25. AVFOR, was calculated to be 519,522,377 ha.

Equation 3.11. Equation for Calculating the Total Available National Forest Area for Unplanned Deforestation.

AVFOR = TOTFOR - PROTFOR - MANFOR

Table 3.25. Parameters and Values used to Calculate the Total Available National Forest Area for Unplanned Deforestation.

Parameter	**Description**	**Value**	**Justification/Source**
AVFOR	Total available national forest area for unplanned deforestation; ha	519,522,377	
TOTFOR	Total available national forest area; ha	519,522,377	page 17, 2010 Brazil FRA
PROTFOR	Total area of fully protected forests nationally; ha	0	Conservatively set to zero
MANFOR	Total area of forests under active management nationally; ha	0	Conservatively set to zero

FAO. 2009. Global Forest Resources Assessment 2010, Brazil Country Report. Forestry Department, Food and Agriculture Organization of the United Nations, Rome.

Next, the ratio (PROPLB) of the forested area of the leakage belt (LBFOR) to the total available national forest area (AVFOR) was calculated. PROPLB = 41,134 ha / 519,522,377 ha = 0.0000792.

The area weighed mean live aboveground tree carbon stock (COLB) was calculated for Brazilian forest using data from Global Forest Resources Assessment 2010, Brazil Country Report [53] as found in Table 3.26. COLB =372 t CO2-e ha-1

Table 3.26. Live Aboveground Biomass Carbon Stocks in Amazonian Forests.

Natural Forest Biome	**Area[1] (ha) in 2010**	**Aboveground Biomass Carbon Stock[2] M t C**	**AGB t C /ha**	**AGB t CO2/ha**
Amazon	354,389,794	44,298.70	125	458
Cerrado	70,007,832	2,396.70	34	126
Caatinga	46,774,120	1,380.80	30	108
Atlantic Forest	28,818,263	3,432.10	119	437
Pantanal	8,554,246	292.27	34	125
Pampa	3,560,541	424.00	119	437
Forest Plantations	7,417,580	520.80	70	257
Total Area of Forest	519,522,377		Area weighted Average	372.3

[53] FAO. 2009. Global Forest Resources Assessment 2010, Brazil Country Report. Forestry Department, Food and Agriculture Organization of the United Nations, Rome.

The FAO publication Global Forest Resources Assessment 2010, Brazil Country Report was the source of information for the area of AVFOR, the forest strata, and the stocks of aboveground biomass carbon present in each strata.

The area weighted average aboveground tree carbon stock for forests available for unplanned deforestation inside the leakage belt (CLB) was calculated using data found in Section 3.1.4.

CLB = 417.8 t CO_2e ha-1.

The proportional difference in carbon stocks between areas of forest available for unplanned deforestation both inside and outside the leakage belt (PROPCS) was calculated as PROPCS = 372 t CO2-e ha-1 / 417.8 t CO_2e ha-1 = 0.891.

The proportional leakage for areas with immigrating populations was calculated using Equation 3.12. The values for the parameters used in this equation can be found in Table 3.27.

Equation 3.12. Equation for Calculating the Proportional Leakage for Areas with Immigrating Populations.

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

Table 3.27. Parameters and Values used to Calculate the Proportional Leakage for Areas with Immigrating Populations.

Parameter	**Description**	**Value**	**Justification/Source**
LKPROP	Proportional leakage for areas with immigrating populations; proportion	0.047	
PROPIMM	Estimated proportion of baseline deforestation caused by immigrating population; proportion	0.053	Estimated above
PROPLB	Area of forest available for unplanned deforestation as a proportion of the total national forest area available for unplanned deforestation; proportion	0.0000792	Calculated above
PROPCS	The proportional difference in stocks between areas of forest available for unplanned deforestation both inside and outside the Leakage Belt; proportion	0.891	Calculated above

The net leakage outside the leakage belt (ΔCLK-ASU,OLB) is calculated ex-ante using Equation 3.13. The values for the parameters used in this equation can be found in Table 3.28. Annual values for ΔCLK-ASU,OLB were calculated in Table 3.29.

Equation 3.13. Equation[54] for Calculating the Net CO_2 Emissions due to Unplanned Deforestation Displaced Outside the Leakage Belt.

$$\Delta C_{LK\text{-}ASU,OLB} = \Delta C_{P,LB} - \Delta C_{BSL,LK,unplanned} * LK_{PROP}$$

Table 3.28. Parameters and Values used to Calculate the Net CO_2 Emissions due to Unplanned Deforestation Displaced Outside the Leakage Belt.

Parameter	**Description**	**Value**	**Justification/Source**
ΔCLK-ASU,OLB	Net CO_2 emissions due to unplanned deforestation displaced outside the leakage belt; t CO_2e	Calculated in Table 3.29, below.	
ΔCBSL,LK,unplanned	Net CO_2 equivalent emissions in the baseline from unplanned deforestation in the leakage belt; t CO_2e	See Table 3.22.	Calculated above
ΔCP,LB	Net CO_2 equivalent emissions within the leakage belt in the project case; t CO_2e	See Table 3.24.	Calculated above
LKPROP	Proportional leakage for areas with immigrating populations; proportion	0.047	Calculated above

Table 3.29. Calculation of Net CO_2 Emissions due to Unplanned Deforestation Displaced Outside the Leakage Belt.

Year	ΔCP,LB (t CO2-e)	ΔCBSL,LK,unplanned (t CO2-e)	LKPROP	ΔCLK-ASU,OLB (t CO2-e)
2012	23,899	19,640	0.047	200
2013	222,524	199,322	0.047	1,088
2014	352,239	324,228	0.047	1,314
2015	307,240	280,306	0.047	1,263
2016	307,299	278,868	0.047	1,333
2017	279,681	254,422	0.047	1,184
2018	313,034	284,379	0.047	1,344
2019	326,736	296,371	0.047	1,424
2020	277,746	250,856	0.047	1,261
2021	342,452	310,875	0.047	1,481

[54] This equation is incorrect in the methodology. Leakage should be calculated as with project emissions minus baseline emissions.

Emissions from Leakage Prevention Activities

Leakage prevention measures do not include the use of fertilizers or the burning of biomass. As such, greenhouse gas emissions as a result of leakage of avoided deforestation activities (GHGLK,E) are assumed to be zero.

Estimation of Total Leakage due to the Displacement of Unplanned Deforestation

The total leakage due to the displacement of unplanned deforestation is estimated in Table 3.31 using Equation 3.14. GHG emissions are not included in the project boundary.

Equation 3.14. Equation for Estimation of Total Leakage due to the Displacement of Unplanned Deforestation.

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

Table 3.30. Parameters and Values used to Estimate Total Leakage due to the Displacement of Unplanned Deforestation.

Parameter	**Description**	**Value**	**Justification**
ΔCLK-AS,unplanned	Net greenhouse gas emissions due to activity shifting leakage for projects preventing unplanned deforestation Net CO_2 emissions; t CO_2e	See Table 3.31	Calculated
ΔCLK-ASU-OLB	Net CO_2 emissions due to unplanned deforestation displaced outside the leakage belt; t CO_2e	See Table 3.29.	Calculated
ΔCLK-ASU-LB	Net CO_2 emissions due to unplanned deforestation displaced from the project area to the leakage belt; t CO_2e	See Table 3.24.	Calculated.

Table 3.31. Calculation of the Total Leakage due to the Displacement of Unplanned Deforestation.

Year	ΔCLK-ASU-OLB (t CO2-e)	ΔCLK-ASU-LB (t CO2-e)	GHGLK,E (t CO2-e)	ΔCLK-AS,unplanned (t CO2-e)
2012	200	4,259	0	4,459
2013	1,088	23,202	0	24,290
2014	1,314	28,011	0	29,325
2015	1,263	26,934	0	28,197
2016	1,333	28,431	0	29,764
2017	1,184	25,259	0	26,443
2018	1,344	28,655	0	29,999
2019	1,424	30,365	0	31,789
2020	1,261	26,889	0	28,150
2021	1,481	31,577	0	33,057
Total	11,891	253,583	0	265,474

3.4 Summary of GHG Emission Reductions and Removals

Estimates of GHG credits eligible for issuance as VCUs were calculated in Table 3.32, 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 3.32. 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})
2012	38,698	10,307	4,459	10%	2,839	21,094
2013	208,895	54,226	24,290	10%	15,467	114,912
2014	249,489	62,763	29,325	10%	18,673	138,728
2015	237,080	57,533	28,197	10%	17,955	133,395
2016	248,286	58,764	29,764	10%	18,952	140,807
2017	217,530	49,149	26,443	10%	16,838	125,100
2018	245,939	54,918	29,999	10%	19,102	141,920
2019	259,260	56,841	31,789	10%	20,242	150,389
2020	225,632	46,380	28,150	10%	17,925	133,177
2021	265,878	55,379	33,057	10%	21,050	156,391

Over the first 10 year baseline period, the project area is expected to results in 1,690,429 tons t CO_2e reductions with a buffer pool contribution of 169,043 t CO_2e and a total expected emission reduction of 1,255,912 t CO_2e after account for leakage (265,474 t CO_2e).

Table 3.33. Emissions Reductions (t CO2-e) Expected to be Generated by the Russas 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)	1,690,429
Buffer pool contribution	169,043
Leakage	265,474
Total Emission Reductions	1,255,912

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:	$\Delta C_{BSL,PA,unplanned}$
Data unit:	t CO_2-e
Description:	Net CO_2 emissions in the baseline from unplanned deforestation in the project area
Source of data:	Derived in Section 3.1 of PD
Value applied:	Set at start of baseline period
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
Any comment:	

Data Unit / Parameter:	$\Delta C_{BSL,LK,unplanned}$
Data unit:	t CO_2-e
Description:	Net CO_2 emissions in the baseline from unplanned deforestation in the leakage belt
Source of data:	Derived in Section 3.1 and 3.2 of PD
Value applied:	Set at start of baseline period
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
Any comment:	

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
Any comment:	

Data Unit / Parameter:	C_{OLB}
Data unit:	t CO_2-e ha^{-1}
Description:	Area-weighted average aboveground tree carbon stock for forests available for unplanned deforestation outside the Leakage Belt
Source of data:	Derived from source data found in FAO. 2009. Global Forest Resources Assessment 2010, Brazil Country Report. Forestry Department, Food and Agriculture Organization of the United Nations, Rome.
Value applied:	372.3 t CO_2-e ha^{-1}
Justification of choice of data or description of measurement methods and procedures applied:	Derived above in Section 3.3 of the PD
Any comment:	

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. Note that:

- “value applied” is left blank because all parameters in this section are monitored
- “monitoring equipment” is left blank to provide flexibility in measurement and monitoring approach, essential for any long-term MRV plan
- Where a parameter is calculated from a methodology equation (i.e. not raw data), the methodology module and equation number is specified and “Description of measurement methods and procedures to be applied” and “QA/QC procedures to be applied” are appropriately left blank
- To avoid repetition and maintain an economical use of space in the summary tables, “Description of measurement methods and procedures to be applied” and “QA/QC procedures to be applied” for monitored (not calculated) parameters reference detailed accounts of procedures provided in the monitoring plan description 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:	
Frequency of monitoring/recording:	Every ≤ 5 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	Equation 3, VMD0015
Any comment:	

Data Unit / Parameter:	$\Delta C_{P,DefLB,i,t}$
Data unit:	t CO_2-e
Description:	Net carbon stock change as a result of deforestation in the project case in the leakage belt in stratum *i* at time *t*
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording:	Every ≤ 5 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	Equation 4, VMD0015
Any comment:	

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:	
Frequency of monitoring/recording:	Every ≤ 5 years
Value applied:	
Monitoring equipment:	

QA/QC procedures to be applied:	
Calculation method:	Equation 20, VMD0015
Any comment:	

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.
Frequency of monitoring/recording:	Every $\leq$ 5 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description
Calculation method:	
Any comment:	

Data Unit / Parameter:	$A_{DefLB,u,i,t}$
Data unit:	Ha
Description:	Area of recorded deforestation in the leakage belt 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 provided below under monitoring plan description.
Frequency of monitoring/recording:	Every $\leq$ 5 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description
Calculation method:	
Any comment:	

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.
Frequency of monitoring/recording:	Every $\leq$ 5 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description
Calculation method:	
Any comment:	

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
Frequency of monitoring/recording:	Every $\leq$ 10 years.
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description
Calculation method:	
Any comment:	

Data Unit / Parameter:	$\Delta Cpools,Def,u,i,t$
Data unit:	t CO_2-e ha^{-1}
Description:	Carbon stock in all pools in post-deforestation land use *u* in stratum *i*
Source of data:	Calculated.

Description of measurement methods and procedures to be applied:	None
Frequency of monitoring/recording:	Every $\leq$ 10 years.
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description
Calculation method:	
Any comment:	

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.
Frequency of monitoring/recording:	Repeated each time the PRA indicates a potential for degradation. PRA conducted every $\leq$ 2 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description.
Calculation method:	
Any comment:	

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.

Frequency of monitoring/recording:	Every ≤ 5 years where surveys and limited sampling continue to indicate possibility of illegal logging in the project area
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description.
Calculation method:	
Any comment:	

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.
Frequency of monitoring/recording:	Every ≤ 5 years where surveys and limited sampling continue to indicate possibility of illegal logging in the project area
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description.
Calculation method:	
Any comment:	

Data Unit / Parameter:	$\Delta C_{P,DegW,i,t}$
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:	
Frequency of monitoring/recording:	Every ≤ 5 years where surveys and limited sampling continue to indicate possibility of illegal logging in the project area

Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	Equation 8, VMD0015
Any comment:	

Data Unit / Parameter:	$PROP_{IMM}$
Data unit:	Proportion
Description:	Estimated proportion of baseline deforestation caused by immigrating population
Source of data:	Calculated based on results of survey of communities in the area around the project.
Description of measurement methods and procedures to be applied:	Detailed procedures provided below under monitoring plan description.
Frequency of monitoring/recording:	Every $\leq$ 5 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
Any comment:	

Data Unit / Parameter:	$PROP_{RES}$
Data unit:	Proportion
Description:	Estimated proportion of baseline deforestation caused by population that has been resident for ≥5 years
Source of data:	Calculated based on results of survey of communities in the area around the project.
Description of measurement methods and procedures to be applied:	Detailed procedures provided below under monitoring plan description.
Frequency of monitoring/recording:	Every $\leq$ 5 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	

Calculation method:	
Any comment:	

Data Unit / Parameter:	*TOTFOR*
Data unit:	ha
Description:	Total available national forest area
Source of data:	Official data, peer reviewed publications, remotely sensed imagery (coarse scale imagery is appropriate) or cadastral maps and other verifiable sources
Description of measurement methods and procedures to be applied:	Not applicable
Frequency of monitoring/recording:	Prior to each verification event and at least every 5 years.
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
Any comment:	

Data Unit / Parameter:	*PROTFOR*
Data unit:	ha
Description:	Total area of fully protected forests nationally
Source of data:	Official data, peer reviewed publications and other verifiable sources
Description of measurement methods and procedures to be applied:	Not applicable
Frequency of monitoring/recording:	Prior to each verification event and at least every 5 years.
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
Any comment:	

Data Unit / Parameter:	*MANFOR*
Data unit:	ha
Description:	Total area of forests under active management nationally
Source of data:	Official data, peer reviewed publications and other verifiable sources
Description of measurement methods and procedures to be applied:	Not applicable
Frequency of monitoring/recording:	Prior to each verification event and at least every 5 years.
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
Any comment:	

Data Unit / Parameter:	*ARRL,forest,t*
Data unit:	ha
Description:	Remaining area of forest in RRL at time t
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording:	Prior to each verification event and at least every 5 years.
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	Calculated as the total area of the RRL minus all nonforested areas.
Any comment:	

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* $A_{DistPA,q,i,t}$

Description of measurement methods and procedures to be applied:	Monitored as part of $A_{DistPA,q,i,t}$
Frequency of monitoring/recording:	Every $\leq$ 5 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description
Calculation method:	Aburn,q,i,t.= $A_{DistPA,q,i,t}$ for stratum where the natural disturbance included fire
Any comment:	

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
Frequency of monitoring/recording:	Every $\leq$ 10 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	Detailed procedures are provided below under monitoring plan description.
Calculation method:	
Any comment:	

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
Frequency of monitoring/recording:	Every $\leq$ 10 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	Detailed procedures are provided below under monitoring plan description.

Calculation method:	
Any comment:	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
Frequency of monitoring/recording:	Every $\leq$ 10 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	Detailed procedures are provided below under monitoring plan description.
Calculation method:	
Any comment:	

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
Frequency of monitoring/recording:	Every $\leq$ 10 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	Detailed procedures are provided below under monitoring plan description.
Calculation method:	
Any comment:	

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
Frequency of monitoring/recording:	Every $\leq$ 10 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	Detailed procedures are provided below under monitoring plan description.
Calculation method:	
Any comment:	

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
Frequency of monitoring/recording:	Every $\leq$ 10 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	Detailed procedures are provided below under monitoring plan description.
Calculation method:	
Any comment:	

4.3 Description of the 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 belt. 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 baseline or 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 4.6. These organizations are responsible for implementing all aspects of a particular monitoring task, as described in the monitoring sub-sections below.

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 unplanned deforestation in the project area to the year in which the disturbance occurred. Stock estimates from the initial field inventory completed in 2013, 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
ARRL,forest,t	Remaining area of forest in RRL at time t	Ha	Updated prior to each verification event

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. 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 (and leakage belt boundary), as set in the PD, will serve as the initial “forest cover benchmark map” against which changes in forest cover will be assessed over the interval of the first monitoring period; the entire project area has been demonstrated to meet the forest definition at the beginning of the crediting period. 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.

The area of remaining forest in the RRL (ARRL,forest,t) is derived by subtracting by the nonforested area within the RRL, as found in the forest benchmark map (updated at each monitoring event), from the total area of the RRL.

Monitoring Illegal Degradation

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 Russas property adjacent to the project area; and
- Nearby ranches and rural properties, along the Jurua and Valparaiso Rivers and secondary roads approaching the project area.

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), temporary sample plots will be allocated and measured in the area of the project indicated by the surveys as a potential source area for illegally-harvested wood. The potential degradation area within the project area ($A_{DegW,i}$) will be delineated based on survey results, incorporating general area information and maximum depth of penetration. Rectangular plots 10 meters by 1 kilometer (1 ha area) will be randomly or systematically allocated in the area, sufficient to produce a 1% 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.

In the event that the sample plot assessment indicated that illegal logging is occurring in the area, supplemental plots will be allocated to achieve a 3% sample of the area. 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 more intensive 3% sample will be carried out once every 5 years where surveys and limited sampling 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 alternative land uses 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)."

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 Leakage

Leakage by local agents of deforestation is quantified in the leakage belt. The area deforested in the leakage belt (ADefLB,i,t) is estimated in the same manner as the area deforested in the with project case ($A_{DefPA,u,i,t}$) using the procedures outlined above in the monitoring deforestation section. Activity shifting leakage within the leakage belt (ΔCLK-ASU-LB) is then calculated as the with project emissions in the leakage belt (ΔCP,LB) minus the baseline emissions in the leakage belt (ΔCBSL,LK,unplanned).

Table 4.4 Data and Parameters for Monitoring Activity Shifting Leakage.

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

ΔCP,LB	Net greenhouse gas emissions within the leakage belt in the project case	t CO_2e	Calculated
ADefLB,i,t	Area of recorded deforestation in the leakage belt at time t	ha	Monitored for each verification event
$\Delta C_{P,Def,i,t}$	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

Immigrant leakage is calculated using a series of equations found in the LK-ASU module. Most of the data for calculating immigrant leakage has been derived for the ex-ante estimates (including ΔCBSL,LK,unplanned; AVFOR; TOTFOR; PROTFOR; MANFOR; PROPLB; LBFOR; COLB; CLB; PROPCS; and ABSL,PA,unplanned,t) or gathered in the course of monitoring activity shifting leakage within the leakage belt and deforestation in the project area (including ADefPA; ADefLB,i,t; and ΔCP,LB).

The monitoring parameters MANFOR, PROTFOR, TOTFOR will be sourced from official data, peer reviewed publications or other verifiable sources, such as the Brazil Global Forest Resources Assessment Report published by the FAO and these monitoring parameters will be updated on review of current literature at least every 5 years. Demonstration that managed and protected forests will be protected against deforestation will further be demonstrated, as stipulated in the LK-ASU module.

Monitoring immigrant leakage will therefore consist of implementing surveys in communities living within 2 kilometers of the boundaries of the leakage belt and project area to determine what proportion of the agents of deforestation have been resident in and around the leakage belt and project area for ≥ 5 years (PROPRES) and the proportion of area deforested by population that has migrated into the area in the last 5 years (PROPIMM). As it is extremely sensitive to ask explicit questions regarding responsibility for deforestation, “the proportion of area deforested by population that has migrated into the area in the last 5 years” is assumed to be equal to the percentage of recent immigrants among local population with potential access to the project area (i.e. without directly asking if they are deforestation agents). Similarly, the “proportion of baseline deforestation caused by population that has been resident for ≥5 years” is assumed to be equal to the percentage of the local population residing in the area longer than 5 years with potential access to the project area.

Table 4.5 Data and Parameters for Monitoring Immigrant Leakage.

Parameter	**Description**	**Units**	**Source/ Justification of Choice of Data or Description of Measurement Methods**
PROPIMM	Proportion of area deforested by immigrant agents in the leakage belt and project area	proportion	Monitored prior to each verification event and at least every 5 years
PROPRES	Proportion of baseline deforestation caused by population that has been resident for ≥5 years	proportion	Monitored prior to each verification event and at least every 5 years

TOTFOR	Total available national forest area	ha	Monitored prior to each verification event and at least every 5 years
PROTFOR	Total area of fully protected forests nationally	ha	Monitored prior to each verification event and at least every 5 years
MANFOR	Total area of forests under active management nationally	ha	Monitored prior to each verification event and at least every 5 years

Updating Forest Carbon Stocks Estimates

Forest carbon stock estimates will be derived from field measurements less than or equal to 10 years old. Sample plots will be randomly located in areas within the Russas 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 Russas and Valparaiso Properties, Acre State, Brazil," 2013).

For live trees, biomass is calculated as a function of diameter at breast height (DBH; in cm) using the predictive model developed by Brown[55] 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

For palms, height and dbh (a conservative estimate of 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) = $0.5*\Pi*(\text{basal diameter(cm)}/200)^2*\text{height(m)}*0.31$ Equation 4.2

Root biomass density is estimated at the cluster sample level applying the equation developed by Cairns et al.[56] , where

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

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

[56] 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.

The volume of lying dead wood per unit area is estimated using the equation (Warren and Olsen[57]) as modified by Van Wagner[58] separately for each dead wood density class:

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

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".

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[59] Guidelines for National Greenhouse Gas Inventories).

Revision of the Baseline

The baseline will be revised every 10 years from the project start date.

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 datasets used to

[57] Warren, W.G. and Olsen, P.F. (1964) A line intersect technique for assessing logging waste. Forest Science 10: 267-276.
[58] Van Wagner, C.E. (1968). The line intersect method in forest fuel sampling. Forest Science 14: 20-26.
[59] IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Chapter 4 AFOLU (Agriculture, Forestry and Other Land-use).

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

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).

Accuracy of the classification 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 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 a review of the current literature at least every 5 years to source information on the area of the monitoring parameters MANFOR, PROTFOR, and TOTFOR. Further, participatory rural appraisals used to assess the length of time people have been living in the project area and leakage belt will be implemented by personnel with experience conducting community surveys in rural Brazil.

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.

Data Archiving

Data archived will be maintained through at least two years beyond the end of the project crediting period. 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, Russas Project staff will ensure that data collection, processing, analysis, management and archiving are conducted in accordance with the monitoring plan.

Table 4.6. Type of Monitoring and Party Responsible for Monitoring.

Variables to be monitored	Responsible	Frequency
Monitoring deforestation and natural disturbance	I.S.R.C.	Prior to each verification
Monitoring illegal degradation	I.S.R.C.	Every two years
Monitoring project emissions	CarbonCo	Prior to each verification
Activity shifting immigrant leakage assessment	I.S.R.C.	Prior to each verification event and at least every 5 years.
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. This REDD 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 Russas 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 Russas 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.[60] The Southwestern Amazon is also home to many endemic species. According to the World Wildlife Fund, there are approximately 42 endemic species in the Southwestern Amazon.[61]

For more details, please see the CCBS project document.

[60] IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2. <www.iucnredlist.org>. Downloaded on 01 February 2012.
[61] World Wildlife Fund, “Southwest Amazon moist forests: Export Species,” Available: http://www.worldwildlife.org/science/wildfinder/

6 STAKEHOLDER COMMENTS

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

- I.S.R.C. Investimentos e Acessória LTDA, specifically Ilderlei Souza Rodrigues Cordeiro
- Communities living within the Russas Project
- Carbonfund.org Foundation, Inc. and CarbonCo, LLC
- Freitas Group International LLC and Carbon Securities
- TerraCarbon
- TECMAN LTDA
- Professor Antonio Willian Flores de Melo of UFAC
- Landowners and Communities living around the Russas Project, particularly the Valparaiso Project
- State of Acre, particularly the:
    - Climate Change Institute of Acre (IMC)
    - State of Acre's CEFLORA (Centro de Formação e Tecnologia da Floresta or the Center for Training and Forest Technology)
    - The Secretary of Small Business
    - The Secretary of Environmental Affairs for the Municipality of Cruzeiro do Sul
- S.O.S. Amazônia

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

March 9-18, 2011 - CarbonCo, Carbon Securities and TerraCarbon travelled to Acre, Brazil to conduct a preliminary assessment of REDD projects in Acre. 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;
- CarbonCo, Carbon Securities and TerraCarbon met with the Chico Mendes Institute on Thursday, March 17th to discuss forest conservation and payment for ecosystem services schemes, such as REDD; and
- Carbon Securities and TerraCarbon met with Acre State Officials, including Monica Julissa De Los Rios de Leal and Eufran Amaral, on Friday, March 18th.

March 17, 2011 – Ilderlei Souza Rodrigues Cordeiro met with the Russas Project's local communities to discuss the Project and an "ata" was signed, which supports the Project State Date.

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

- CarbonCo, Carbon Securities, TerraCarbon, and TECMAN met with Acre State officials, including Monica Julissa De Los Rios de Leal and Lucio Flavio, on Wednesday, August 3rd to discuss how to best design forest carbon inventories to align with the State of Acre's goals and future forest inventory plans;
- TerraCarbon led a classroom forest carbon inventory training for TECMAN field crew for the Purus Project. TECMAN would later be hired for the Russas Project.
- TerraCarbon trained TECMAN field crew members in forest inventory practices and standard operating procedures, which would later be used during the Russas Project's forest carbon inventory.
- 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.

October 31, 2011 - Tri-Party Agreement was executed by CarbonCo, Carbon Securities, and Ilderlei Souza Rodrigues Cordeiro.

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.

November and December 2011 - Ilderlei Souza Rodrigues Cordeiro informally met with the local community to discuss the Russas Project and informally met local officials (including the mayor) in Cruzeiro do Sul.

December 2011 - CarbonCo and Carbon Securities met Ilderlei Souza Rodrigues Cordeiro in person for the first time during a presentation to landowners in Acre, Brazil about REDD+ projects. Ilderlei Souza Rodrigues Cordeiro began talking with Normando Sales who was working with CarbonCo and Carbon Securities on the Purus Project.

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 offset; Where to go for REDD information on Federal government updates and how to inform Government of our Project

March 2012 - Ilderlei Souza Rodrigues Cordeiro met again with the local community to discuss the Project. The local community expressed the desire to work with açaí, which was later incorporated into the agriculture surveys. The area's biodiversity was also discussed and this is when the idea to reintroduce the Amazonian manatee was raised. The community explained the Amazonian manatee used to exist in the Valparaiso River, but now there are none remaining.

March 26, 2012 – CarbonCo and TerraCarbon held a follow up call with Monica Julissa De Los Rios de Leal to discuss a variety of topics, including, how to register VCS REDD+ projects with the State of Acre.

March-April 2012 – Ilderlei Souza Rodrigues Cordeiro informally contacted José Augusto Rocha, the Secretary of Environment for the city of Guajará, about the idea of reintroducing the Amazonian manatee to the Valparaiso River.

May 2012 – Ilderlei Souza Rodrigues Cordeiro spoke to Professor Paulo Bernarde from the Federal University of Acre in Cruzeiro do Sul. Professor Bernarde is the coordinator of environmental courses at the University. The discussion focused on biodiversity of the Project and the Professor expressed interest in cataloguing species on the Project.

June 2012 – CarbonCo met with André Luis Botelho de Moura, a former graduate student of Dr. Armando Muniz Calouro, to begin refining a full biodiversity plan for the Purus Project. Such discussions included: the proper locations of cameras; a short, Standard Operating Procedures (SOPs) guidance document to be developed that will be used as a training manual for the communities; the communities need to be trained on the proper placement and preventative maintenance of such cameras, and the cameras need to be setup in the field; periodic movement of cameras to different strata; assistance for one year to periodically identify species. This full biodiversity monitoring plan will be adapted for the Russas Project.

June 20-22, 2012 – CarbonCo, Carbon Securities and TerraCarbon traveled to the Russas and Valparaiso Projects to conduct a preliminary assessment of the projects, to observe the local drivers and agents of deforestation, and to informally meet with several local communities.

Figure 6.1. Photograph of community meeting.

November 2012 – Ilderlei Souza Rodrigues Cordeiro spoke to Fernando Lima, the President of Instituto de Meio Ambiente do Acre (IMAC, "Environmental Institute of Acre" in English) to discuss the Project and requested a letter of approval. The discussion focused on how IMAC can help control deforestation in the Project.

January 2013 – Ilderlei Souza Rodrigues Cordeiro met with some community members in Cruzeiro do Sul. The community was stopping deforestation and wanted to know how they would benefit from the project. Ultimately, the community needs to eat and cannot see their incomes or food production decrease. Ilderlei explained the Project is underway, but there is a lot of work to be done, and assured the community they would receive benefits.

February 2013 – Ilderlei Souza Rodrigues Cordeiro received feedback from José Augusto Rocha about the Amazonian manatee reintroduction. José contacted Associação Amigos do Peixe-Boi (Friends of the Manatee Association) in the State of Amazonas. José introduced Ilderlei to Diogo Alexandre de Souza, a biologist at the Association. Ilderlei registered with the Association, provided his area for reintroduction of the Amazonian manatee, and was sent pictures.

February 2013 – Ilderlei contacted Miguel Scarcello from S.O.S Amazônia. S.O.S Amazônia wanted to reintroduce turtles ("quelonios" in Portuguese). S.O.S Amazônia also has courses they want to teach to the local communities at the Russas Project about forest preservation.

February 2013 – Throughout February 2013, Ilderlei Souza Rodrigues Cordeiro held several short calls with organizations such as Instituto Nacional de Colonização e Reforma Agrária (INCRA), Instituto de Terra do Acre (ITERACRE), Secretary of Tourism for the State of Acre, Secretary of Agriculture, and Secretary of Commerce to explain the Project and ask for a letter of support.

February 2013 – Ilderlei Souza Rodrigues Cordeiro met with the State of Acre Congressional Assembly, presented the project, and received a letter of support. Ilderlei also met Eufran Amaral, Mónica Julissa De Los Rios de Leal and Pavel Jezek from the Climate Change Institute (IMC) of Acre in Rio Branco. Ilderlei discussed the Project, received a letter of support, and also received the necessary paperwork to register the Project with IMC. In addition, IMC would like the completed Project Design Document and any supporting documentation to be filed with the IMC.

March 2013 – The Russas Project filed the registration paperwork with the IMC. Ilderlei contacted Sarney Filho, the Federal Minister of Environment Affairs, along with the President of the Commission of Environmental Affairs of the Federal Congress and President Jerônimo Goergen of the Amazon Commission of the House of Representatives, to inform them of the Project.

March 27, 2013 – Carbon Securities, with CarbonCo, Ilderlei Souza Rodrigues Cordeiro, Manoel Batista Lopes (landowner of the Valparaiso Project), Roberto Catão (Advisor to the Valparaiso Project) and Normando Sales (landowner of the Purus Project) in attendance, presented the Russas and Valparaiso Projects to the President of the Cruzeiro do Sul Municipal Legislature, the Secretary of Environmental Affairs for the Cruzeiro do Sul municipality, along with staff members of the Secretary of Agriculture for the Cruzeiro do Sul. The presentation gave an overview of the Project Proponents, the objectives of the Projects, the reason for Carbon Securities and CarbonCo's visit to Cruzeiro do Sul, the basic timeline of the Projects, how the Projects are implemented and the main activities to be implemented, the legal basis for the Projects, and concluded with a question and answer session. The Project Proponents learned that the municipality has a fund for agricultural courses devoted to local families.

March 30 - April 1, 2013 – CarbonCo, Carbon Securities, Ilderlei Souza Rodrigues Cordeiro, and Sebastião Tome de Melo Junior (son-in-law of Manoel Batista Lopes) visited the Russas-Valparaiso communities, further discussed the Projects, and administered the Household Survey and Participatory Rural Assessment (PRA), Basic Necessity Survey (BNS), and the Agricultural Surveys.

April 2, 2013 - CarbonCo, Carbon Securities, and Ilderlei Souza Rodrigues Cordeiro met again with Maria Francisca R. Nascimento, the Secretary of Environmental Affairs for the Municipality of Cruzeiro do Sul to further discuss the Valparaiso and Jurua River Basins' biodiversity as part of the Projects' rapid assessment of biodiversity

April 4, 2013 - CarbonCo, Carbon Securities, and Ilderlei Souza Rodrigues Cordeiro met Edgar de Deus, the State Secretary of Environmental Affairs to introduce the Project Proponents and explained the Purus, Valparaiso and Russas Projects.

April 5, 2013 - CarbonCo, Carbon Securities, and Ilderlei Souza Rodrigues Cordeiro met Miguel Scarcello, the Secretary General from S.O.S. Amazônia to: introduce the Project Proponents, explain the Projects and particularly the biodiversity aspects, explained the role of the Verified Carbon Standard and the Climate, Community and Biodiversity Standards.

April 5, 2013 - CarbonCo, Carbon Securities, and Ilderlei Souza Rodrigues Cordeiro met again with Eufran Amaral from the Climate Change Institute to give an update on all the Projects and an update 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-CCB validated REDD+ Project in Acre and that Russas and Valparaiso Projects were undergoing VCS-CCB validation later in 2013.

May 11-15, 2013 - Ilderlei Souza Rodrigues Cordeiro visited the Russas-Valparaiso Projects to administer additional Household Survey and Participatory Rural Assessment (PRA), Basic Necessity Survey (BNS), and the Agricultural Surveys.

May 21, 2013 - Ilderlei Souza Rodrigues Cordeiro met the Vice President of Brazil, Michel Temer, to discuss the Russas-Valparaiso Project and asking for the support of the Federal Government.

Mechanisms for Ongoing Communication

CarbonCo, Carbon Securities, and Ilderlei Souza Rodrigues Cordeiro are committed to meet in person at least once per year at the Russas Project with the local community to discuss project activities, project management, and to 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 Russas Project employs forest patrols to prevent encroachment by outside actors into the project area.	2
c)	Management team does not include individuals with significant experience in all skills necessary to successfully undertake all project activities.	2
d)	Local management partners are based in Cruzeiro do Sul 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 "Tensas River National Wildlife Refuge Afforestation Project" 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.		**2**

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.	-2
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	As the majority of baseline activities over the length of the project crediting period are subsistence-driven, an NPV analysis is not required. This risk category will be revised downward, once net positive community impacts can be clearly demonstrated, such as through certification against the Climate, Community & Biodiversity Standards or results of a participatory assessment of the project activities on the local communities which demonstrates net positive community benefits.	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 60 year period (i.e. greater than 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 60 year period from the project start date.	0

	The landowners of the property are under contractual obligations[62] 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 forest for livestock / cattle ranches; ii. Clearing forest for agriculture; iii. Expanding old roads or constructing new roads; iv. Expanding into new forests for infrastructure (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		0
Total Internal Risks		
Total Internal Risks (PM + FV + OC + PL) Total may not be less than zero.		**8**

A1.2. EXTERNAL RISKS

Land Tenure and Resource Access/Impacts		
Risk Factor	Risk Factor and/or Mitigation Description	Risk Rating
a)	The land owner, Ilderlei Souza Rodrigues Cordeiro, who is also a project proponent (I.S.R.C.), owns the project area outright (see Section 1.12) and has full resource access/use rights, who 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.	0
e)	Not applicable.	0
f)	There is a legal contractual agreement to maintain the project area as forest for at least a 60 year period (i.e. greater than 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

[62] See addendum to the Tri-Party Agreement located in the project database.

Community Engagement		
Risk Factor	Risk Factor and/or Mitigation Description	Risk Rating
a)	All households living on the Russas 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 2007 through 2011 is 0.06, 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.[63]	-2
Total Political (PC) [as applicable ((a, b, c, d or e) + f)] Total may not be less than zero.		0

Table A1. Calculation of Brazil's average governance score.

Governance Indicator	**2007**	**2008**	**2009**	**2010**	**2011**
Control of Corruption	-0.12	-0.02	-0.11	0.05	0.17
Government Effectiveness	-0.13	-0.02	0.02	0.07	-0.01
Political Stability	-0.32	-0.24	0.23	0.08	-0.04
Regulatory Quality	-0.05	0.04	0.14	0.17	0.17
Rule of Law	-0.44	-0.37	-0.20	0.00	0.01
Voice and Accountability	0.51	0.54	0.49	0.53	0.50
Overall Mean					0.06

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

[63] 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[64] 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[65]. 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[66] 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

[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.
[65]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.
[66] 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[67], 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.[68]
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

[67] For more information see the results of the "Forest biomass carbon inventory for the Russas and Valparaiso Properties, Acre State, Brazil" in the project database.
[68] 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	8
b) External Risk	0
c) Natural Risk	2
Overall Risk Rating (a + b + c)	**10**

The Russas Project will employ a non-permanence risk deduction of 10%.

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:

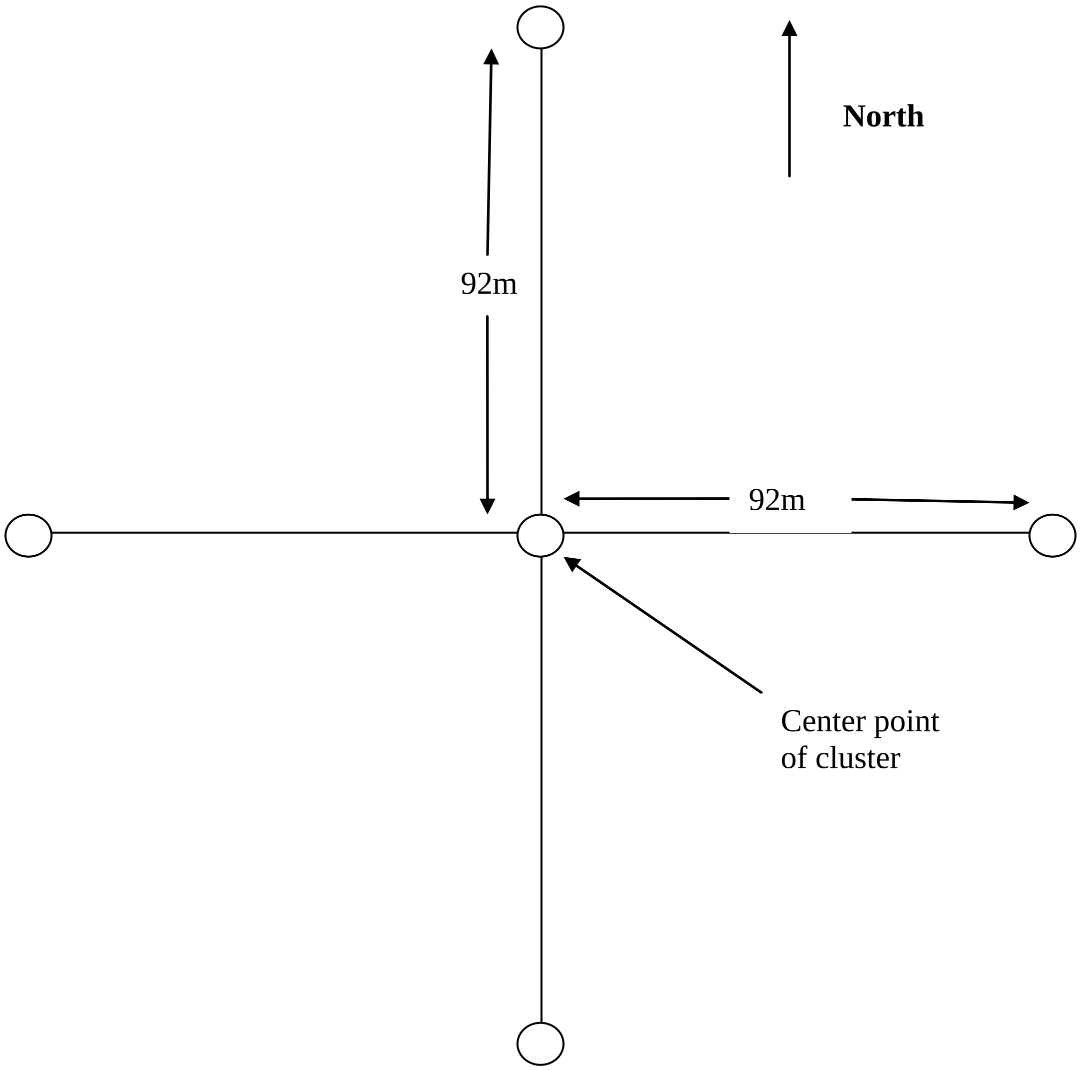
- Aboveground live tree biomass (including palms and bamboo)
- Belowground live tree biomass
- Standing dead wood
- Lying dead wood

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.

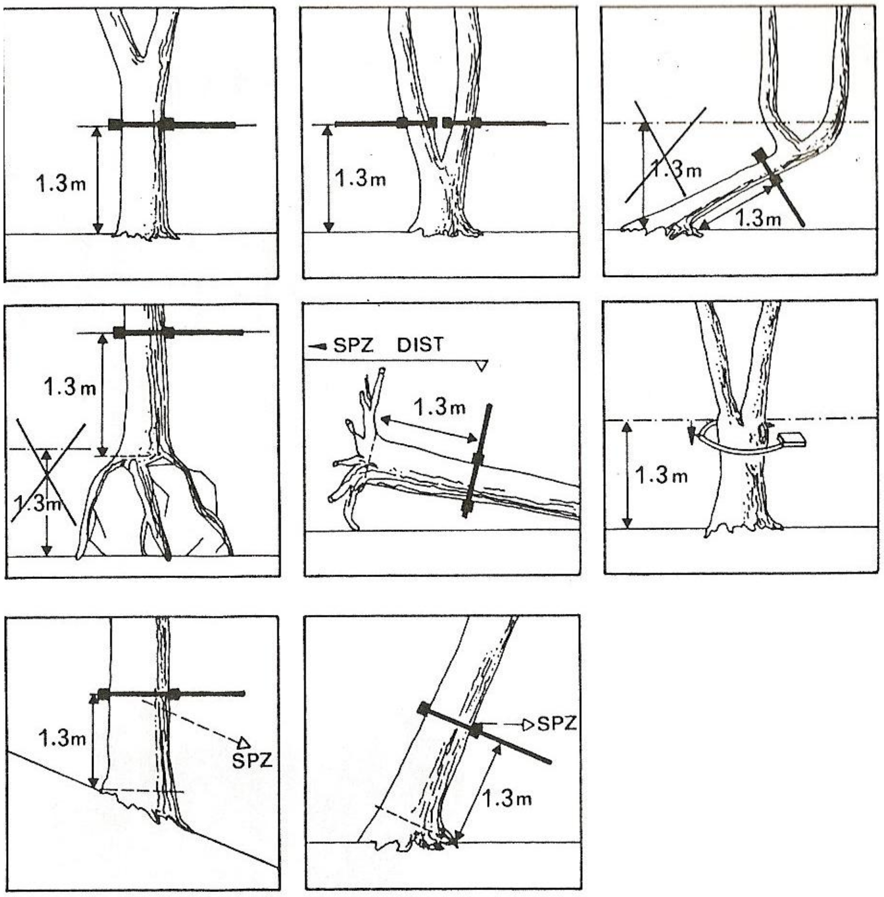
B2.3 Measurement of live trees

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). Diameter of trees with buttresses will be measured directly above the point of termination of the buttress (Figure B2.2). Species (or genera or common name) will also be recorded.

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

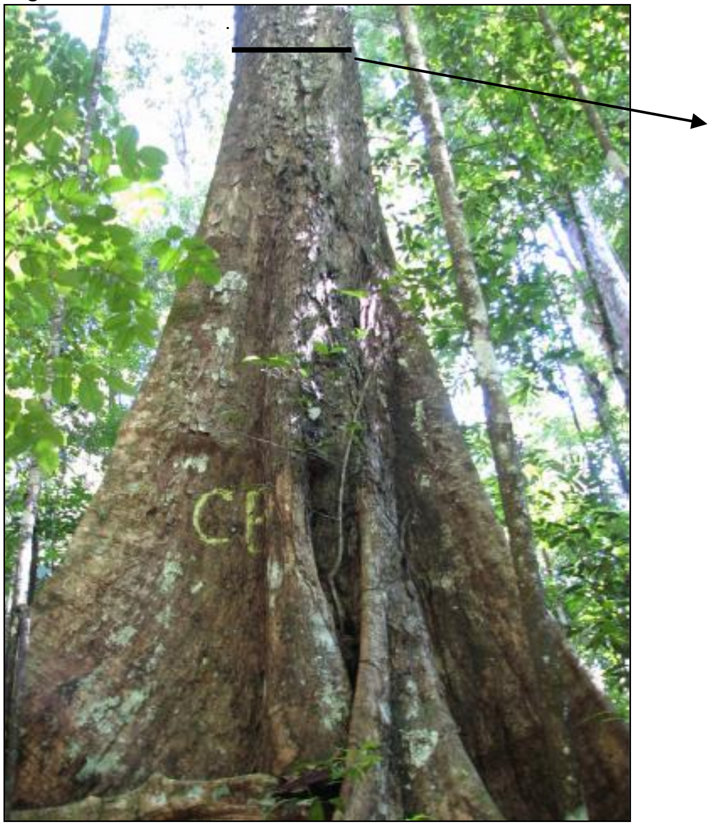
Where palms are encountered that meet the minimum dbh threshold, two measurements will be taken: basal diameter and height to the top of the stem.

Figure B2.1. Point of measurement of diameter at breast height (from Pancel[69], 1993).



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

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



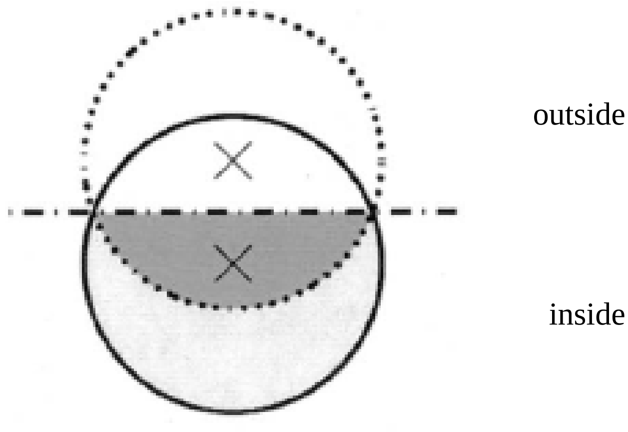
Point for measurement for DBH

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[70] (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.

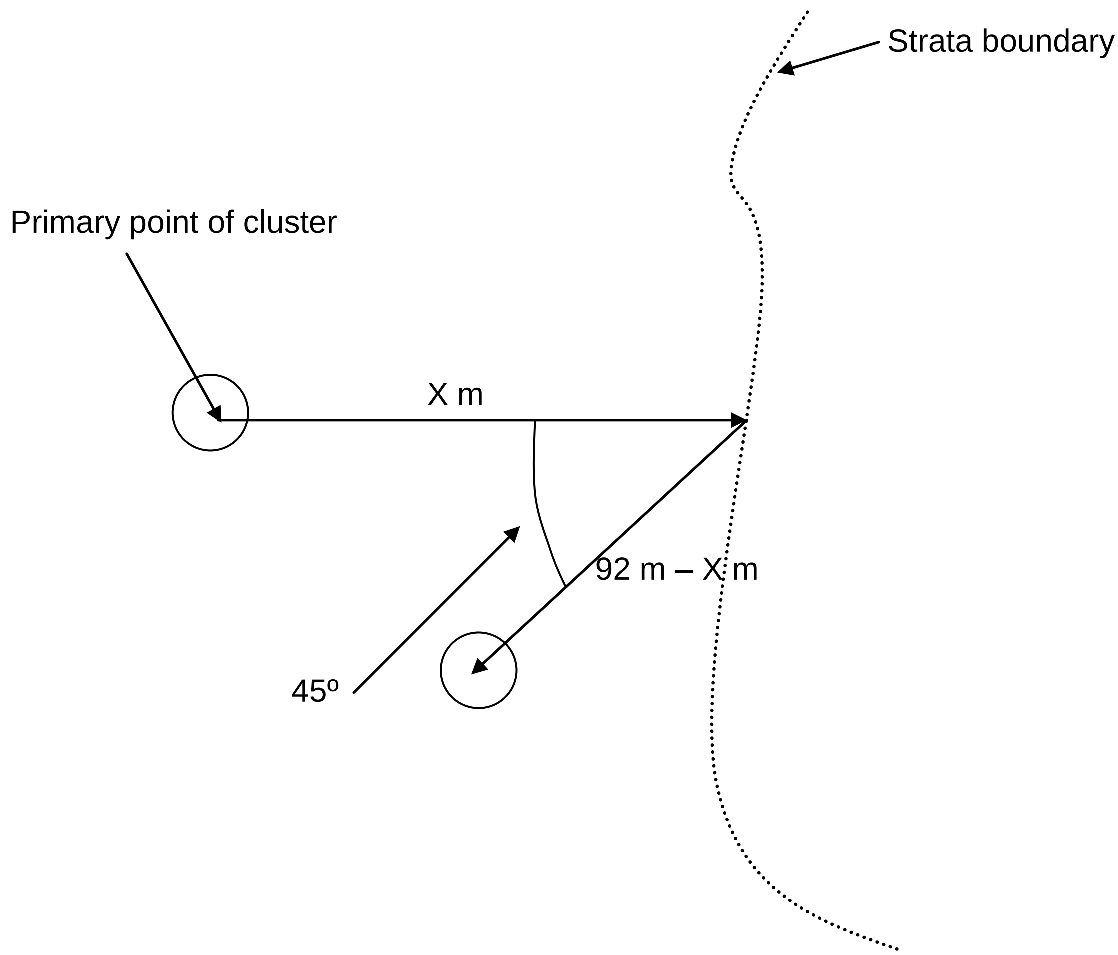
[70]Avery, T.E. and H.E. Burkhart. 1994. Forest Measurements. Fourth Edition. McGraw Hill, Boston, Massachusetts, USA. 408 pp.

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 ≥ 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

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. 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[71] or the Brazilian Association of technical rules. Volume is determined by 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.

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

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.