THE JAGUAR AMAZON REDD PROJECT

Document Prepared by GREENOXX SC

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Project Lifetime	01 January 2018 - 15 July 2041; Renewable
GHG Accounting Period	01 January 2018 - 31 December 2057; 40-year total period
History of CCB Status	No previous validations were carried out

Gold Level Criteria	Biodiversity Gold Level
Expected Verification Schedule	1st Quarter, 2021

Table of Contents

1 Summary of Project Benefits 7
1.1 Unique Project Benefits 7
1.2 Standardized Benefit Metrics 7
2 General 10
2.1 Project Goals, Design and Long-Term Viability 10
2.1.1 Summary Description of the Project (G1.2) 10
2.1.2 Project Scale 12
2.1.3 Project Proponent (G1.1) 13
2.1.4 Other Entities Involved in the Project 13
2.1.5 Physical Parameters (G1.3) 13
2.1.6 Social Parameters (G1.3) 20
2.1.7 Project Zone Map (G1.4-7, G1.13, CM1.2, B1.2) 27
2.1.8 Stakeholder Identification (G1.5) 29
2.1.9 Stakeholder Descriptions (G1.6, G1.13) 29
2.1.10 Sectoral Scope and Project Type 31
2.1.11 Project Activities and Theory of Change (G1.8) 31
2.1.12 Sustainable Development 32
2.1.13 Implementation Schedule (G1.9) 33
2.1.14 Project Start Date 33
2.1.15 Benefits Assessment and Crediting Period (G1.9) 34
2.1.16 Differences in Assessment/Project Crediting Periods (G1.9) 34
2.1.17 Estimated GHG Emission Reductions or Removals 34
2.1.18 Risks to the Project (G1.10) 34
2.1.19 Benefit Permanence (G1.11) 35
2.1.20 Financial Sustainability (G1.12) 36
2.1.21 Grouped Projects 36
2.2 Without-project Land Use Scenario and Additionality 37
2.2.1 Land Use Scenarios without the Project (G2.1) 37
2.2.2 Most-Likely Scenario Justification (G2.1) 38
2.2.3 Community and Biodiversity Additionality (G2.2) 39
2.2.4 Benefits to be used as Offsets (G2.2) 39
2.3 Stakeholder Engagement 39
2.3.1 Stakeholder Access to Project Documents (G3.1) 39
2.3.2 Dissemination of Summary Project Documents (G3.1) 41
2.3.3 Informational Meetings with Stakeholders (G3.1) 41
2.3.4 Community Costs, Risks, and Benefits (G3.2) 41
2.3.5 Information to Stakeholders on Validation and Verification Process (G3.3) 42

2.3.6 Site Visit Information and Opportunities to Communicate with Auditor (G3.3) 43
2.3.7 Stakeholder Consultations (G3.4) 43
2.3.8 Continued Consultation and Adaptive Management (G3.4) 43
2.3.9 Stakeholder Consultation Channels (G3.5) 44
2.3.10 Stakeholder Participation in Decision-Making and Implementation (G3.6) 44
2.3.11 Anti-Discrimination Assurance (G3.7) 44
2.3.12 Feedback and Grievance Redress Procedure (G3.8) 44
2.3.13 Accessibility of the Feedback and Grievance Redress Procedure (G3.8) 45
2.3.14 Worker Training (G3.9) 46
2.3.15 Community Employment Opportunities (G3.10) 46
2.3.16 Relevant Laws and Regulations Related to Worker's Rights (G3.11) 46
2.3.17 Occupational Safety Assessment (G3.12) 49
2.4 Management Capacity 50
2.4.1 Project Governance Structures (G4.1) 50
2.4.2 Required Technical Skills (G4.2) 51
2.4.3 Management Team Experience (G4.2) 51
2.4.4 Project Management Partnerships/Team Development (G4.2) 51
2.4.5 Financial Health of Implementing Organization(s) (G4.3) 51
2.4.6 Avoidance of Corruption and Other Unethical Behavior (G4.3) 52
2.4.7 Commercially Sensitive Information (Rules 3.5.13 – 3.5.14) 52
2.5 Legal Status and Property Rights 52
2.5.1 Statutory and Customary Property Rights (G5.1) 52
2.5.2 Recognition of Property Rights (G5.1) 53
2.5.3 Free, Prior and Informed Consent (G5.2) 54
2.5.4 Property Rights Protection (G5.3) 54
2.5.5 Illegal Activity Identification (G5.4) 55
2.5.6 Ongoing Disputes (G5.5) 56
2.5.7 National and Local Laws (G5.6) 56
2.5.8 Approvals (G5.7) 64
2.5.9 Project Ownership (G5.8) 64
2.5.10 Management of Double Counting Risk (G5.9) 64
2.5.11 Emissions Trading Programs and Other Binding Limits 64
2.5.12 Other Forms of Environmental Credit 64
2.5.13 Participation under Other GHG Programs 64
2.5.14 Projects Rejected by Other GHG Programs 64
2.5.15 Double Counting (G5.9) 65
3 Climate 65
3.1 Application of Methodology 65
3.1.1 Title and Reference of Methodology 65

3.1.2 Applicability of Methodology 65
3.1.3 Project Boundary 92
3.1.4 Baseline Scenario 104
3.1.5 Additionality 116
3.1.6 Methodology Deviations 121
3.2 Quantification of GHG Emission Reductions and Removals 122
3.2.1 Baseline Emissions 122
3.2.2 Project Emissions 140
3.2.3 Leakage 146
3.2.4 Net GHG Emission Reductions and Removals 159
3.3 Monitoring 170
3.3.1 Data and Parameters Available at Validation 170
3.3.2 Data and Parameters Monitored 173
3.3.3 Monitoring Plan 191
3.3.4 Dissemination of Monitoring Plan and Results (CL4.2) 193
3.4 Optional Criterion: Climate Change Adaptation Benefits 194
3.4.1 Regional Climate Change Scenarios (GL1.1) 194
3.4.2 Climate Change Impacts (GL1.2) 194
3.4.3 Measures Needed and Designed for Adaptation (GL1.3) 194
4 Community 194
4.1 Without-Project Community Scenario 194
4.1.1 Descriptions of Communities at Project Start (CM1.1) 194
4.1.2 Interactions between Communities and Community Groups (CM1.1) 203
4.1.3 High Conservation Values (CM1.2) 203
4.1.4 Without-Project Scenario: Community (CM1.3) 203
4.2 Net Positive Community Impacts 204
4.2.1 Expected Community Impacts (CM2.1) 204
4.2.2 Negative Community Impact Mitigation (CM2.2) 205
4.2.3 Net Positive Community Well-Being (CM2.3, GL1.4) 206
4.2.4 High Conservation Values Protected (CM2.4) 206
4.3 Other Stakeholder Impacts 206
4.3.1 Impacts on Other Stakeholders (CM3.1) 206
4.3.2 Mitigation of Negative Impacts on Other Stakeholders (CM3.2) 207
4.3.3 Net Impacts on Other Stakeholders (CM3.3) 208
4.4 Community Impact Monitoring 208
4.4.1 Community Monitoring Plan (CM4.1, CM4.2, GL1.4, GL2.2, GL2.3, GL2.5) 208
4.4.2 Monitoring Plan Dissemination (CM4.3) 210
4.5 Optional Criterion: Exceptional Community Benefits 210
4.5.1 Exceptional Community Criteria (GL2.1) 210

4.5.2 Short-term and Long-term Community Benefits (GL2.2) 210
4.5.3 Community Participation Risks (GL2.3) 210
4.5.4 Marginalized and/or Vulnerable Community Groups (GL2.4) 210
4.5.5 Net Impacts on Women (GL2.5) 210
4.5.6 Benefit Sharing Mechanisms (GL2.6) 210
4.5.7 Benefits, Costs, and Risks Communication (GL2.7) 210
4.5.8 Governance and Implementation Structures (GL2.8) 211
4.5.9 Smallholders/Community Members Capacity Development (GL2.9) 211
5 Biodiversity 211
5.1 Without-Project Biodiversity Scenario 211
5.1.1 Existing Conditions (B1.1) 211
5.1.2 High Conservation Values (B1.2) 215
5.1.3 Without-project Scenario: Biodiversity (B1.3) 216
5.2 Net Positive Biodiversity Impacts 217
5.2.1 Expected Biodiversity Changes (B2.1) 217
5.2.2 Mitigation Measures (B2.3) 219
5.2.3 Net Positive Biodiversity Impacts (B2.2, GL1.4) 219
5.2.4 High Conservation Values Protected (B2.4) 220
5.2.5 Species Used (B2.5) 220
5.2.6 Invasive Species (B2.5) 221
5.2.7 Impacts of Non-native Species (B2.6) 222
5.2.8 GMO Exclusion (B2.7) 222
5.2.9 Inputs Justification (B2.8) 222
5.2.10 Waste Products (B2.9) 222
5.3 Offsite Biodiversity Impacts 223
5.3.1 Negative Offsite Biodiversity Impacts (B3.1) and Mitigation Measures (B3.2) 223
5.3.2 Net Offsite Biodiversity Benefits (B3.3) 224
5.4 Biodiversity Impact Monitoring 224
5.4.1 Biodiversity Monitoring Plan (B4.1, B4.2, GL1.4, GL3.4) 224
5.4.2 Biodiversity Monitoring Plan Dissemination (B4.3) 228
5.5 Optional Criterion: Exceptional Biodiversity Benefits 228
5.5.1 High Biodiversity Conservation Priority Status (GL3.1) 228
5.5.2 Trigger Species Population Trends (GL3.2, GL3.3) 229
Appendices 231
Appendix 1: Stakeholder Identification Table 231
Appendix 2: Project Activities and Theory of Change Table 232
Appendix 3: Project Risks Table 233

DISCLAIMER

The JAGUAR REDD+ PROJECT is aware and supports the nesting process of projects baselines and national FREL, being conducted by the Peruvian Government leaded by MINAM. It implies that, even though the emissions reductions have been calculated for the first 10 years of the project life (until 2027), project partners intend to adopt the national information when it is available and is official and is compatible with the VERRA methodology used in this project. Up to now, all the official information available at this moment has been used. It includes forest loss data, monitoring methodology, stratification and carbon stocks in official forest strata.

It implies that projections used since 2021 are likely to be changed when and if the government of Peru announces a new FREL with a method for quota allocation at project level.

In that sense, project proponent has reviewed and confirms that current project is aligned with VERRA guidelines on nesting described in this link:

https://verra.org/important-considerations-related-to-nesting-of-redd-projects/#esp

1 SUMMARY OF PROJECT BENEFITS

This section highlights some of this project's important benefits. Section 1.1 (Unique Project Benefits) should be aligned with a project's causal model and is specific to this project. Section 1.2 (Standardized Benefit Metrics) is the same quantifiable information for all CCB projects. This section does not replace the development of a project-specific causal model or the monitoring and reporting of all associated project-specific impacts (positive and negative) that are described in Sections 2-5 of this document.

1.1 Unique Project Benefits

TABLE 1: UNIQUE PROJECT BENEFITS

Outcome or Impact Estimated by the End of Project Lifetime	Section Reference
1) Jaguar Conservation	
2) Brazil Nut Conservation	
3) Eco-tourism Initiative	

1.2 Standardized Benefit Metrics

For each metric, provide an estimate of the net benefit the project aims to achieve during the project lifetime. Insert "not applicable" where the metric does not apply and "data not available" where the metric does apply but there are no means of quantification. Estimations included below shall be substantiated in this document as denoted in the corresponding section reference.

Note: Estimations regarding emission reductions and hectares of reduced forest loss in this section are preliminary and subject to confirmation during first verification stage.

TABLE 2: STANDARDIZED METRICS OF THE PROJECT

Category	Metric	Estimated by the End of Project Lifetime	Section Reference
GHG emission reductions or removals	Net estimated emission removals in the project area, measured against the without-project scenario	0	
	Net estimated emission reductions in the project area, measured against the without-project scenario	37,518,511	
Forest[1] cover	For REDD+[2] projects: Estimated number of hectares of reduced forest loss in the project area measured against the without-project scenario	92,093	
	For ARR[3] projects: Estimated number of hectares of forest cover increased in the project area measured against the without-project scenario	Not applicable	
Improved land management	Number of hectares of existing production forest land in which IFM[4] practices are expected to occurred as a result of project activities, measured against the without-project scenario	183,015 hectares	
	Number of hectares of non-forest land in which improved land management practices are expected to occurred as a result of project activities, measured against the without-project scenario	Not applicable	
Training	Total number of community members who are expected to have improved skills and/or knowledge resulting from training provided as part of project activities	293	
	Number of female community members who are expected to have improved skills and/or knowledge resulting from training as part of project activities	26	

[1] Land with woody vegetation that meets an internationally accepted definition (e.g., UNFCCC, FAO or IPCC) of what constitutes a forest, which includes threshold parameters, such as minimum forest area, tree height and level of crown cover, and may include mature, secondary, degraded and wetland forests (*VCS Program Definitions*)

[2] Reduced emissions from deforestation and forest degradation (REDD) - Activities that reduce GHG emissions by slowing or stopping conversion of forests to non-forest land and/or reduce the degradation of forest land where forest biomass is lost (*VCS Program Definitions*)

[3] Afforestation, reforestation and revegetation (ARR) - Activities that increase carbon stocks in woody biomass (and in some cases soils) by establishing, increasing and/or restoring vegetative cover through the planting, sowing and/or human-assisted natural regeneration of woody vegetation (*VCS Program Definitions*)

[4] Improved forest management (IFM) - Activities that change forest management practices and increase carbon stock on forest lands managed for wood products such as saw timber, pulpwood and fuelwood (*VCS Program Definitions*)

Employment	Total number of people expected to be employed in project activities[5], expressed as number of full-time employees[6]	293	
	Number of women expected to be employed as a result of project activities, expressed as number of full-time employees	26	
Livelihoods	Total number of people expected to have improved livelihoods[7] or income generated as a result of project activities	293	
	Number of women expected to have improved livelihoods or income generated as a result of project activities	26	
Health	Total number of people for whom health services are expected to improve as a result of project activities, measured against the without-project scenario	293	
	Number of women for whom health services are expected to improve as a result of project activities, measured against the without-project scenario	26	
Education	Total number of people for whom access to, or quality of, education is expected to improve as result of project activities, measured against the without-project scenario	293	
	Number of women and girls for whom access to, or quality of, education is expected to improve as result of project activities, measured against the without-project scenario	26	
Water	Total number of people who are expected to experience increased water quality and/or improved access to drinking water as a result of project activities, measured against the without-project scenario	293	
	Number of women who are expected to experience increased water quality and/or improved access to drinking water as a result of project activities, measured against the without-project scenario	26	
Well-being	Total number of community members whose well-being[8] is expected to improve as a result of project activities	293	

[5] Employed in project activities means people directly working on project activities in return for compensation (financial or otherwise), including employees, contracted workers, sub-contracted workers and community members that are paid to carry out project-related work.

[6] Full time equivalency is calculated as the total number of hours worked (by full-time, part-time, temporary and/or seasonal staff) divided by the average number of hours worked in full-time jobs within the country, region or economic territory (adapted from the UN System of National Accounts (1993) paragraphs 17.14[15.102]; [17.28])

[7] Livelihoods are the capabilities, assets (including material and social resources) and activities required for a means of living (Krantz, Lasse, 2001. *The Sustainable Livelihood Approach to Poverty Reduction*. SIDA). Livelihood benefits may include benefits reported in the Employment metrics of this table.

[8] Well-being is people's experience of the quality of their lives. Well-being benefits may include benefits reported in other metrics of this table (e.g. Training, Employment, Livelihoods, Health, Education and Water), and may also include other benefits such as strengthened legal rights to resources, increased food security, conservation of access to areas of cultural significance, etc.

	Number of women whose well-being is expected to improve as a result of project activities	26	
Biodiversity conservation	Expected change in the number of hectares managed significantly better by the project for biodiversity conservation[9], measured against the without-project scenario	183,015 hectares	
	Expected number of globally Critically Endangered or Endangered species[10] benefiting from reduced threats as a result of project activities[11], measured against the without-project scenario	24 fauna and 8 flora species are in IUCN list	

2 GENERAL

2.1 Project Goals, Design and Long-Term Viability

2.1.1 Summary Description of the Project (G1.2)

The project is located in Peru, in the south-east area of the Department of Madre de Dios, in the province of Tahuamanu (districts of Iñapari, Iberia and Tahuamanu). The project area (PA) comprises the consolidated Otorongo and Chullachaqui areas covering a total of 183,015 hectares. The coordinates of each forest concession that make up these consolidated projects are shown in Annex 1.

The project is based on the sustainable forest management of certified wood from the consolidated “Inversiones Forestales Chullachaqui SAC” and “Forestal Otorongo SAC” in the Province of Tahuamanu, department of Madre de Dios in southeast Peru.

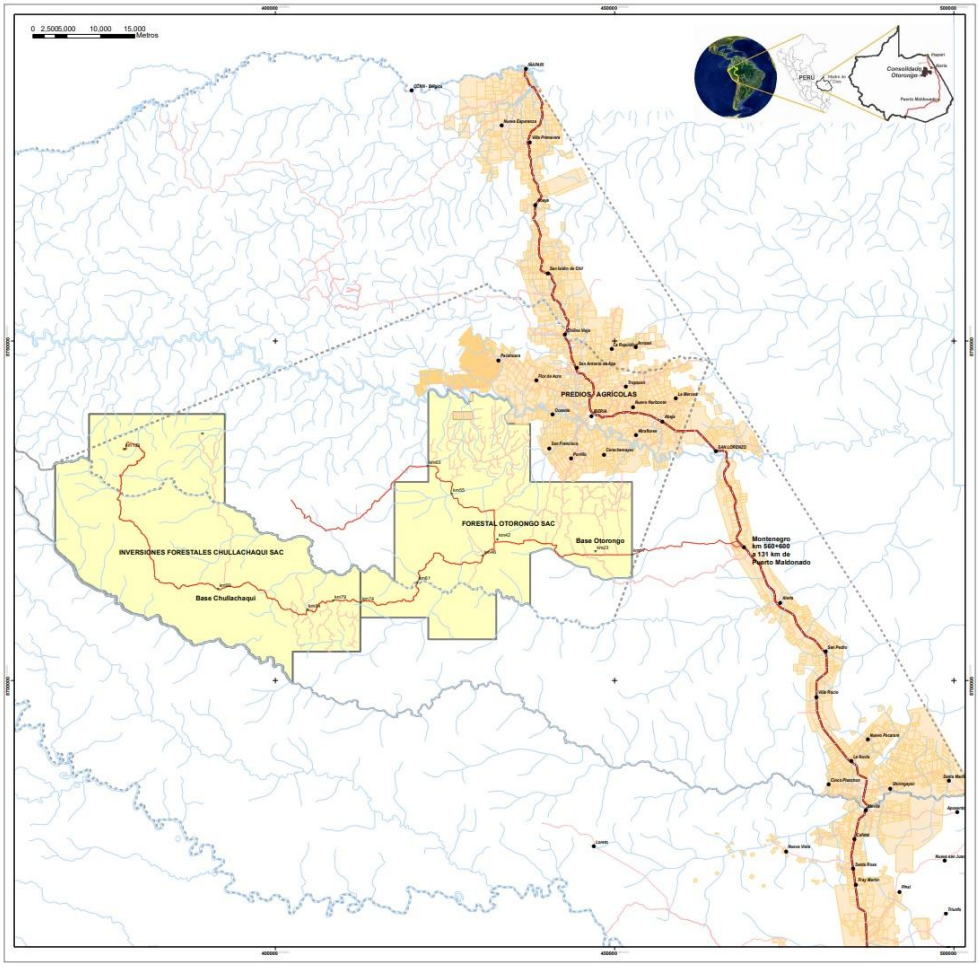
Consolidated “Inversiones Forestales Chullachaqui" is managed by the company Inversiones Forestales Chullachaqui SAC, it is formed by the merge of 4 adjacent concessions, which have made the consolidation of the respective areas in order to optimize the sustainable use of forest resources and enter as a block to the Voluntary Forest Certification process. All the contracts from the Consortium are subscribed by Chullachaqui Forestry Investments. Similarly, Otorongo Consortium is composed of six concessions, with Forestal Otorongo SAC as the holders of those concessions.

Both consolidated companies represent forestry companies that have signed permanent-production-forest concession contracts with the Peruvian State for a period of 40 renewable years initiated between 2002 and 2003, for an area of 183,015 hectares (81,238 hectares for Otorongo and 101,777 hectares for Chullachaqui). This contract grants legal rights over the area for both forest use and environmental services.

[9] Managed for biodiversity conservation in this context means areas where specific management measures are being implemented as a part of project activities with an objective of enhancing biodiversity conservation, e.g. enhancing the status of endangered species
[10] Per IUCN’s Red List of Threatened Species
[11] In the absence of direct population or occupancy measures, measurement of reduced threats may be used as evidence of benefit

Map 1 shows the location of the project in Peru in the department of Madre de Dios, and the area of the project formed by the polygons of both consolidated.

MAP 1: PROJECT LOCATION



Own elaboration

The Project Area is 183,015 hectares and is located 17 km from the interoceanic highway, the main transversal communication route between Peru and Brazil. In addition, the project area operates as part of the Vilcabamba-Amboró Biological Corridor, which would have an area of approximately 30 million hectares.

Within the project area, there are no native indigenous populations. In the towns of Alerta, Portillo, San Francisco and Oceania there are settlers dedicated to collecting Brazil nuts and eventually shiringa. A 100% of the people who extract Brazil nut through a work agreement in partnership with the Company live in Alerta. Peruvian legislation allows for the combination of timber harvesting activities and non-timber products. As a result, a Brazil nut Complementary Management Plan has been developed to develop its use, compatible with wood extraction, minimizing impacts. The company develops meetings with the BN harvesters to exchange proposals of mutual benefit (there are minutes of meetings developed).

The company strictly forbids hunting wild animals in its forest. This undoubtedly contributes to the fulfillment of some specifications described in the FSC certification standards, such as those established in principle 6 (criteria 6.2.2), in the Peruvian regulations (regulation of zoo-breeders and hunting grounds D.S: 018-92-AG; prohibition of hunting, transport, extraction and export D.S: 013-99-AG).

The Chullachaqui SAC Forest Investment Concession aims to promote the conservation of the forest and its resources through sustainable forest management. As part of the preventive measures, mechanisms such as low-impact logging or the design and construction of infrastructure that seeks to reduce the impact on habitats and trees of importance to wildlife are implemented, as well as the prohibition of hunting within the concession and raising awareness among workers about the importance of wildlife in the forest ecosystem. Logging operations directly impacts on the wildlife present in the forest, mainly due to the interventions and the noise generated. The presence of wildlife in forest ecosystems impacted by timber harvesting is important because of its positive influence on natural regeneration processes, which are key to the sustainability of the forest. The diversity of the tropical forest ecosystem is the basis for the richness of its natural resources and its use must be sustainable, without compromising the benefit to future generations.

The general objective of the company is to manage the extension of forest granted by the Peruvian State, improving the production of forest goods and services in a continuous and sustainable manner with an adequate long-term strategy for its implementation.

According to the PGMF 2016, the forest management system used in the concession is of the type “Polycyclic Entresaca”, in which the standing mass is handled, trying to increase the proportion of commercial species in the forest without eliminating undesirable species. Trees that compete directly with trees of future harvest are mainly eliminated. Forest inventory data is used to review the cutting cycle (CC), minimum cutting diameter (DMC) and cutting intensity (IC), and then calculate the allowable annual cut volume (VCAP).

Project Objectives:

- Climate Goal: Reduce the expected deforestation rate and the associated GHG emissions in the project area in the upcoming years
- Community Goal: Promote and consolidate a sustainable use of agrarian land increasing the family incomes without necessity to expand to new areas
- Biodiversity Goal: Protect the rich ecosystem that is home of many significant threatened species of fauna and flora

2.1.2 Project Scale

TABLE 3: PROJECT SCALE

Project Scale	
Project	
Large project	X

2.1.3 Project Proponent (G1.1)

The projects proponents are Greenoxx Sociedad Civil (whose partners are Eng. Rocco Cheirasco and Eng. Silvia Gomez Caviglia) and Forestal Otorongo SAC (which is also the owner of Forestal Chullachaqui SAC).

TABLE 4: GENERAL INFORMATION OF PROJECT PROPONENT

Organization name	Greenoxx Sociedad Civil
Contact person	Eng. Rocco Cheirasco & Eng. Silvia Gómez Caviglia
Title	Chairman CEO & Executive Vice-President
Address	Costa Rica 1661 | of. 7; CP 11500; Montevideo, Uruguay
Telephone	+598 2604 08 69
Email	rocco@greenoxx.com; ngo@greenoxx.com; silvia@greenoxx.com

Organization name	Consolidado Forestal Otorongo SAC
Contact person	Eng. Vittorio De Dea Peña
Title	Legal Representative
Address	Road to La Cachuela Km. 1.8, Tambopata, Madre de Dios, Peru
Telephone	+51 989 067 284
Email	vdedea@bozovich.com

2.1.4 Other Entities Involved in the Project

2.1.5 Physical Parameters (G1.3)

CLIMATE

Santos (2017)[12] indicates that the climate of Madre de Dios is tropical: warm, humid and with annual rainfall over 1000 mm with an average temperature of 17°C to 20°C in the months of June and July and a maximum of up to 36°C in the months of December to March. It is occasionally presenting influences of cold air masses, which come from the southeast of the Americas, causing temperature declines, which reach up to 8°C and are locally known as "friaje". Likewise, it collects the data from the 1981-2015 period for the preparation of the precipitation map where a seasonal rainfall behavior is observed, where the largest accumulated are recorded between January to April and October to December, where the largest accumulated rainfall is in February. The months of

[12] Santos, D. Hydrological characterization of the Madre de Dios region. National Service of Meteorology and Hydrology of Peru (SENAMHI). Hydrology Department. December, 2017.

reduced rainfall are between June and August. The basins of the Madre de Dios region have an average multi-year precipitation of over 1600 mm/yearly, with the basins CO, CP, IAL, IAA being the least humid, with average annual precipitation ranging from 1599.5 to 1793 mm. The Department of Madre de Dios is characterized by three types of climate:

a. Sub Humid and Warm. It includes the north-eastern sector of the department. It is characterized by presenting annual average temperatures of 25°C. A moderately and rainy climate.

b. Humid and Warm. It includes the central and southwestern sector of the department. It is characterized by average annual rainfall of 2,000 mm. and average annual temperatures of 25°C. A rainy climate, dry winter, warm humid season.

c. Very humid and Semi-warm. Includes the foothills of the eastern cordillera. It is characterized by an average annual rainfall of 2,300 mm. and average annual temperatures of 22°C. A very rainy climate with abundant rainfall, almost all year round.

TABLE 5: TYPE OF CLIMATE IN MADRE DE DIOS

Types of Climate	Area (ha)	%
Sub humid and warm	3'687,543	43.3
Humid and warm	1'061,173	12.5
Very humid and semi-warm	3'769,680	44.3
Total	8'518,396	100.0

(IIAP, 2009)

HYDROLOGY

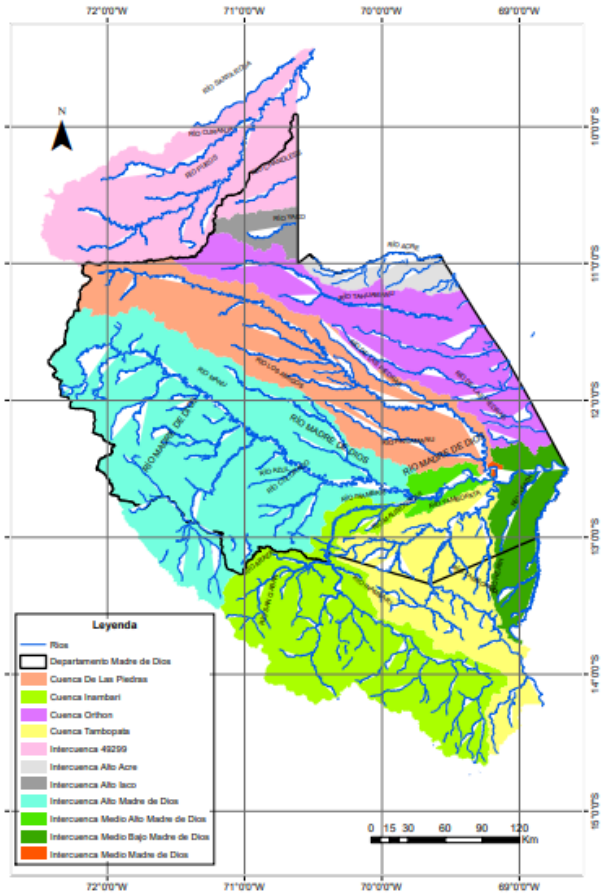
The Local Administration of Agua Maldonado (2010)[13] states that the Madre de Dios Basin is the third largest in the country and is part of the large basins of the Madeira River, a tributary of the Amazon River. In Peruvian territory, it has an area of 111,933 km2, which includes the Inter-basin Acre. The Madre de Dios Basin politically is within three regional governments; 96% extends over Madre de Dios, 32% in Puno and 12% in Cuzco. Nine sub-basins have been defined for the Madre de Dios Basin: Tambopata Basin, Inambari Basin, Las Piedras Basin, Tahuamanu or Orthon Basin, Alto Madre de Dios Inter-basin, Alto Madre de Dios Middle Inter-basin, Madre de Dios Middle Inter-basin, Madre de Dios Middle Lower Inter-basin and the Alto Acre Inter-basin[14].

The Project is located in the Tahuamanu or Orthon Basin, presenting an area of 15,190.20 km2 and a main channel length of 308.51 km, which is located between the provinces of Tahuamanu and Tambopata. The Tahuamanu River travels in a NW-SE direction and crosses the entire province of Tahuamanu. In this sector, its course is meandering presenting meanders and small lagoons. Present a regular width that varies from 150 to 180 m.

MAP 2. WATERSHEDS IN MADRE DE DIOS

[13] Local Water Administration (ALA) Maldonado. Hydrological Diagnostic Study of the Madre de Dios Basin. Water Resources Conservation and Planning Department - Surface Water Area. 2010.

[14] The Alto Acre Inter-basin belongs to the Purus Hydrographic Unit. For the purposes of the Study, it was considered to be within the Madre de Dios Basin.



Source: SENAMHI, 2010

The Consolidated Otorongo borders the Tahuamanu River in the north, the river with the highest flow and navigable all year round. The Muymanu River passes through the concession and is navigable during the winter months (January-March). There are the Cocama and Titimanu gorges, tributaries of the Tahuamanu River which are short-distance and seasonal flows, conditioned to the winter season and the presence of rains in the summer.

In the consolidated Chullachaqui, the main rivers that pass through it are the Muymanu River located in the north and middle and the Manuripe River to the south and is a natural boundary with other concessions. The most important gorges are Buyuyo and Carbajal, since during rainy season they are navigable.

SOILS

Due to the constant arrival of new material from the Andean mountain range, Madre de Dios has relatively young and fertile soils compared to most of the Amazon. The mainland soils, which occupy approximately 80 percent of the department, are consistently sandier, more acidic, and less fertile than floodplain soils. While the appearance and texture of these soils vary greatly from place

to place, the vast majority of soils in Madre de Dios fall into only two categories of the soil taxonomy system: Ultisols and Inceptisols.

At the regional level, soil varieties have been identified and classified according to their origin:

a) Recent Rainfall Soils. Very close to rivers, they occupy low flat-relief terraces that can withstand annual or sporadic flooding.
b) Sub-recent alluvial soils. They have originated from sub-recent quaternary deposits distributed in non-flood plated terraces, from flat to wave decline.
c) Local colluvial soils. Originated from thick materials derived from a mixture of alluvionic sediments and material from mountain formations.
d) Old alluvial soils. Originated by ancient sediments due to the process of fluvial erosion, they have reached heights ranging from 15 to 40 or 50 m, forming the so-called medium and high terraces.
e) Raised floors of waste materials. These are soils that have originated in situ from sedimentary materials from the Tertiary and Quaternary periods (siltstones, sandstones, gravels) and that due to various phenomena have originated low and high hills. In the Manu National Park area, the majority of the study is made up of deep to very shallow soils, located in areas of rugged or very dissected relief, with slopes greater than 50 percent and whose main limitations are related to the rugged topography and very steep to extremely steep slopes, which increase erosion risks.

Taxonomically, the IIAP (2009) has identified five soil orders Entisols, Inceptisols, Histosols, Alphisols and Ultisols; of which it determined 8 suborders, 11 large soil groups. Edaphically, 58 soil series were identified, divided into 28 consociations and 18 soil associations, and a unit of miscellaneous areas has been recognized.

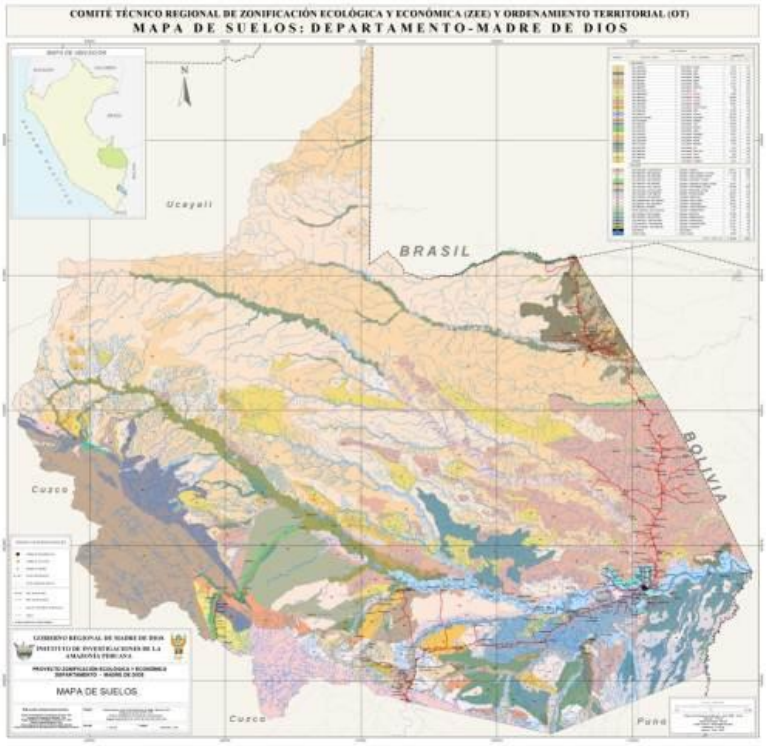
After the technical interpretation of the soils, the IIAP established, according to the Land Classification Regulation (D.S. Nº 0062-75-AG), the following groups of Major Use Capacity. Table 6 below shows the Major Use Capacity Groups in the department of Madre de Dios.

TABLE 6: MAJOR LAND USE CAPACITY BY STRATA IN MADRE DE DIOS

Description	Area (Ha)	%
Lands Suitable for Clean Cultivation	570,613	6.70
Lands Suitable for Permanent Cultivation	1'055,358	12.39
Lands Suitable for Pasture	755,261	8.87
Land suitable for forestry production	4'001,474	46.97
Protection Lands	2'035,632	23.89
Water bodies	1,600	0.02
Urban Areas	98,682	1.16
TOTAL	**8'518,396**	**100.00**

Source: IIAP (2009)

MAP 3: SOIL TYPES ACCORDING TO ECOLOGICAL ECONOMIC ZONING



Source: IIAP (2009)

TYPES OF VEGETATION

Madre de Dios has an area of natural forest of 8,102,917 hectares, which places it in third place in the country of departments with the greatest area of forest, after Ucayali and Loreto (CESVI, 2005).

According to the work carried out by IIAP in 2009, it was determined that the Madre de Dios department has 22 types of natural vegetation that contain at least 2,429 plant species (angiosperms and gymnospermas), including 869 genres and 172 families.

The most extensive types of vegetation are: Mixed communities of bamboo, or mixed pacales, associated with trees scattered in hills (28.84 percent), dense semi-sumycifolium forests in hills (16.98 percent) and dense semi-sumycifolium forests in plains (15.42 percent).

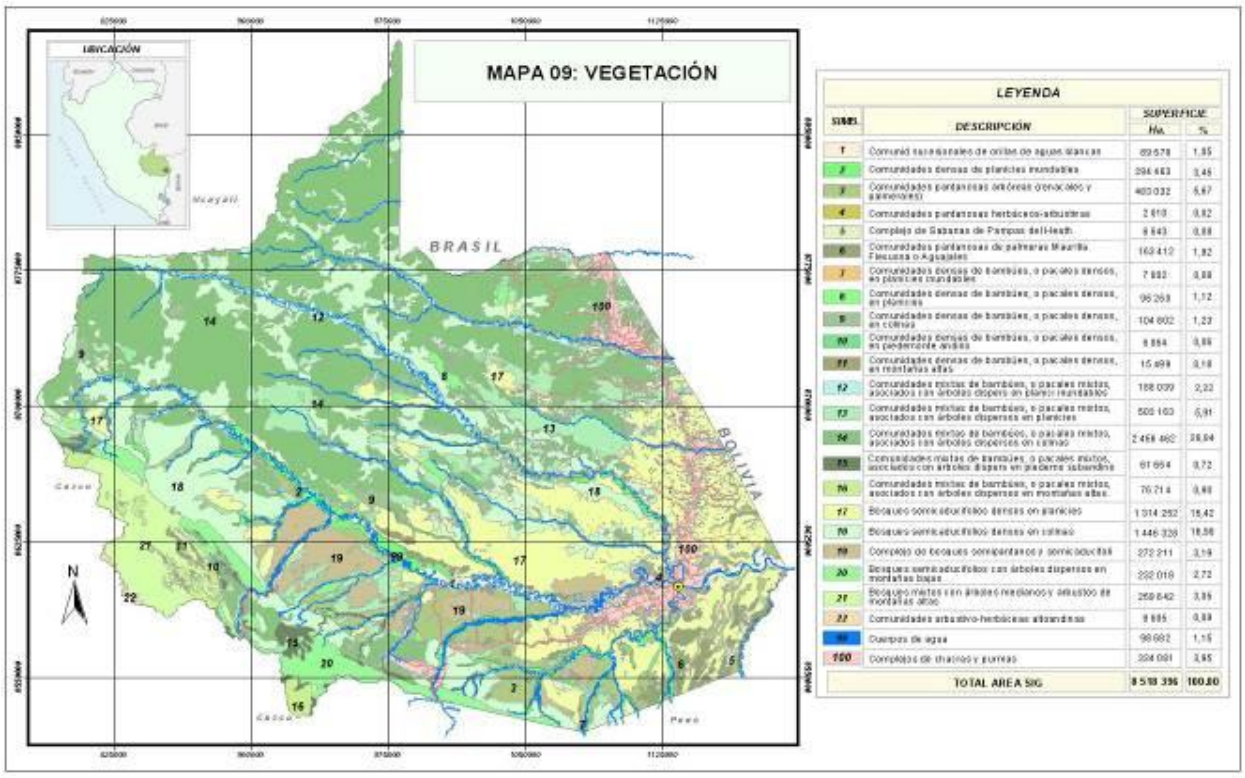
TABLE 7: VEGETATION UNITS IN MADRE DE DIOS

Code	Units of Vegetation	Area (ha)	%
1	Successional communities on the banks of white water	89,578	1.05
2	Dense floodplain communities	294,463	3.45
3	Tree swampy communities (Renacal and palm trees)	483,032	5.67
4	Herbaceous-tree swamp communities	2,010	0.02

5	Pampas del Heath Savannah Complex	6,543	0.08
6	Swamp communities of Mauritia flexuosa or "aguajales" palms	163,412	1.92
7	Dense bamboo communities, or dense pacales, in floodplains	7,002	0.08
8	Dense bamboo communities, or dense pacales, in plains	95,250	1.12
9	Dense communities of bamboos, or dense pacales, on hills	104,802	1.23
10	Dense bamboo communities, or dense pacales, in the Andean foothills	5,054	0.06
11	Dense bamboo communities, or dense pacales, in high mountains	15,499	0.18
12	Mixed communities of bamboos, or mixed pacales, associated with scattered trees on flood plains	188,039	2.22
13	Mixed communities of bamboos, or mixed pacales, associated with scattered trees on plains	503,163	5.91
14	Mixed communities of bamboos, or mixed pacales, associated with trees scattered on hills	2'456,462	28.84
15	Mixed communities of bamboos, or mixed pacales, associated with scattered trees in the sub-Andean foothills	61,654	0.72
16	Mixed communities of bamboos, or mixed pacales, associated with scattered trees in high mountains	76,714	0.90
17	Dense semi-deciduous forests on plains	1'314,252	15.42
18	Dense semi-deciduous hill forests	1'446,328	16.98
19	Complex of semi-panorous and semi-deciduous forests	272,211	3.19
20	Semi-deciduous forests with scattered trees in low mountains	232,018	2.72
21	Mixed forests with medium trees and high mountain shrubs	259,642	3.05
22	High Andean shrub-herb communities	8,505	0.09
99	Water bodies	98,682	1.15
100	Complexes of farms and secondary forest	334,081	3.95
	Total	**8'518,396**	**100.00**

Source: IIAP, 2009

MAP 4: VEGETATION UNITS IN MADRE DE DIOS



Source: IIAP, 2009

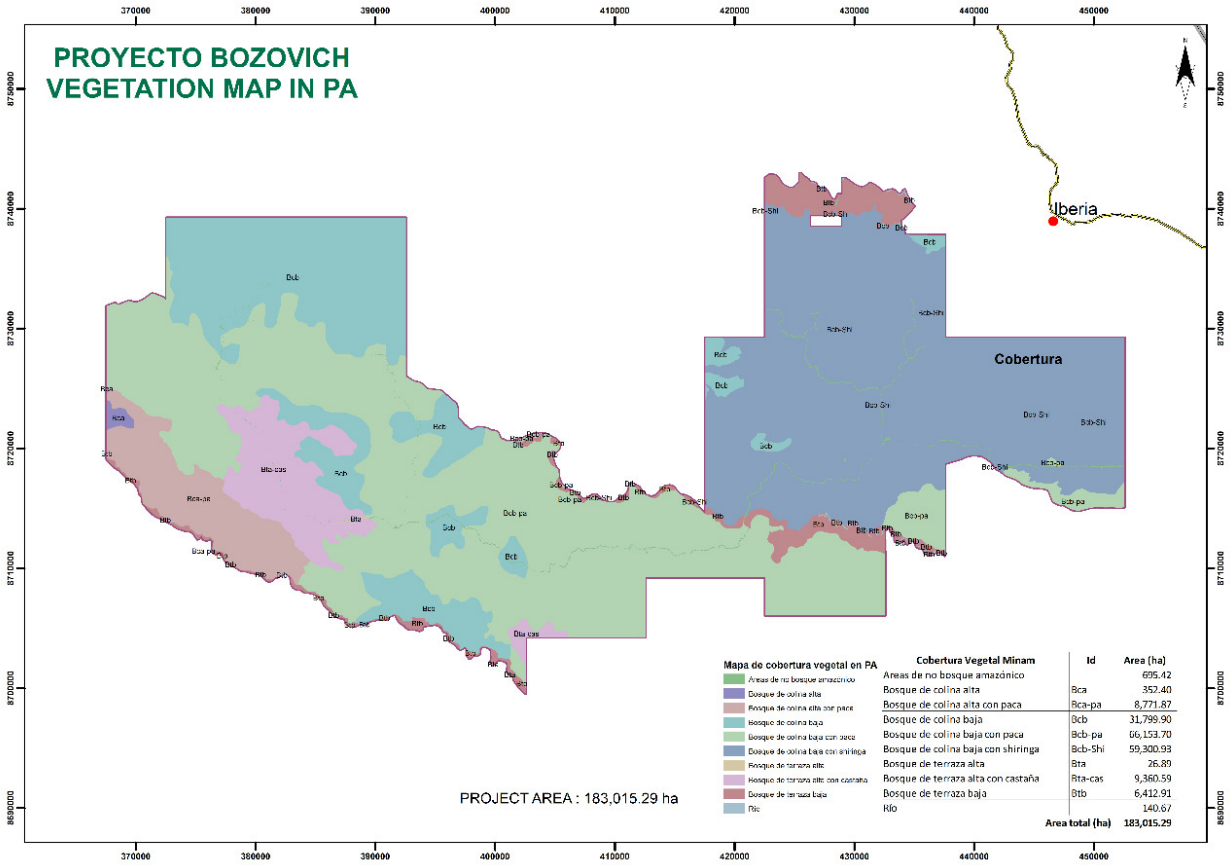
TABLE 8: VEGETATION UNITS IN PROJECT AREA

Units of Vegetation	Area	%
Non-Amazon forest areas	695.42	0.37
High hill forest	352.40	0.18
High hill forest with bale	8,771.87	4.78
Low hill forest	31,799.90	17.37
Low hill forest with bale	66,153.70	36.16
Low hill forest with shiringa	59,300.93	32.39
High terrace forest	26.89	0.13
High terrace forest with Brazil nut	9,360.59	5.10
Low Terrace Forest	6,412.91	3.49
Water bodies	140.67	0.07
Total	183,015.29	100.00

In the project area, the three largest units identified are low hill forest with paca (36.16%), low hill forest with shiringa (32.39%) and low hill forest (17.37%).

In table 8, we can see the different vegetation units within the project area. Map 5 shows the vegetation units within the project area.

MAP 5: VEGETATION UNITS IN PROJECT AREA



Own Elaboration

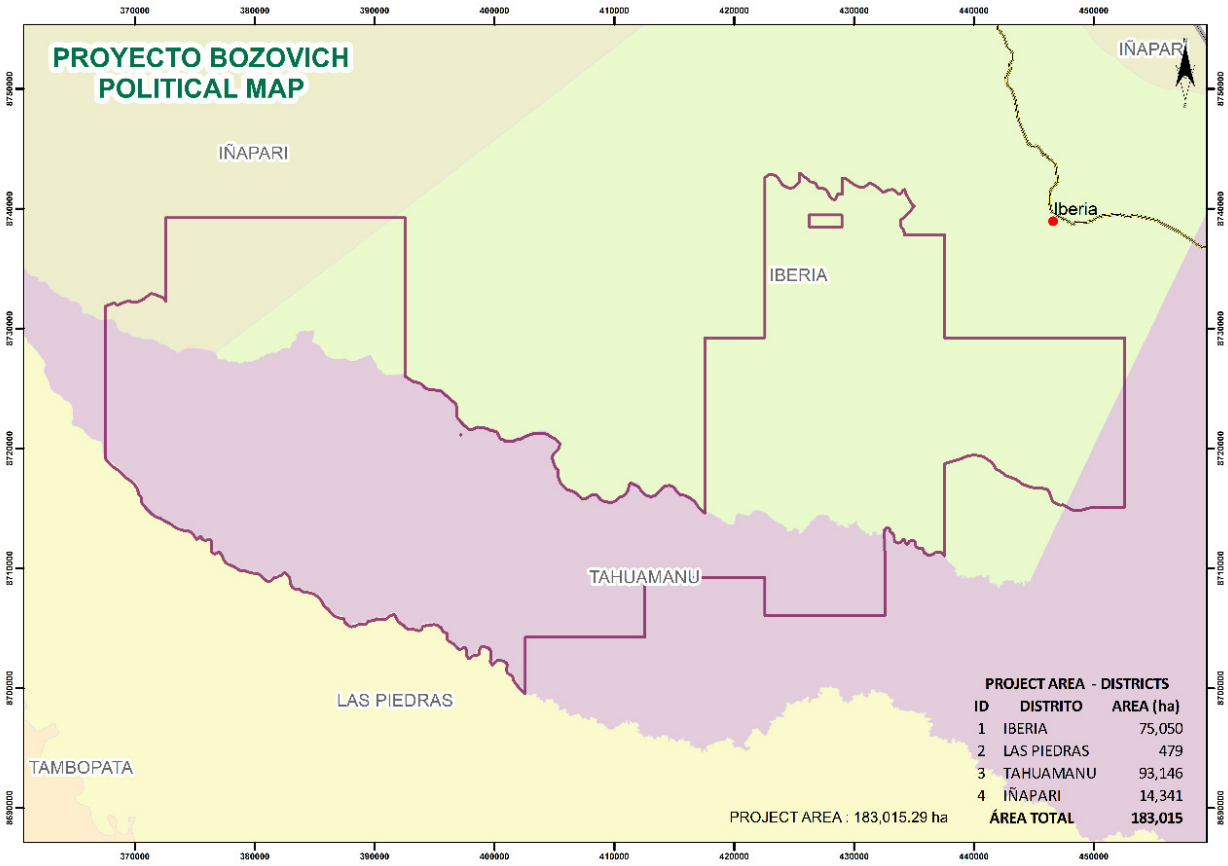
TABLE 9: PROJECT AREA STATUS, 2018

Deforestation	Forest degradation	Natural Regeneration	Forest Restoration
89.34	9,352.19	93,521.87	-

2.1.6 Social Parameters (G1.3)

The Project is located within the Tahuamanu Province. Therefore, the characterization of the population will focus on the districts of Tahuamanu, as well as having the largest surrounding population closest to the project. With respect to the province of Tahuamanu, the project area has a greater extension in the district of the same name covering 93,145 ha (51%); it is followed by the District of Iberia with 75,050 ha (41%) and finally the District of Iñapari with 14,341 ha (7.8%) as can be seen in the following map.

MAP 6: LOCATION OF PROJECT AREA BY DISTRICT



The province of Tahuamanu covers approximately 21,196.86 km^2, which represents 24.85% of the surface area of the department of Madre de Dios, concentrating a population of 10,742 inhabitants (Source: INEI CENSO 2007).

The spatial distribution of the province's population centers is generally located on both sides of the inter-oceanic road, the main communication route with the economic activities that take place there. Likewise, the district capitals generally have better facilities and services due to the use of natural resources, provision of services and others. The population centers of Iñapari, Iberia and San Lorenzo, because they are the current district capitals, show a greater development in infrastructure and services in relation to the other towns in their environment. In the province, there are populated centers like Nueva Esperanza, La Novia, Alerta, San Pedro and Chilina, which present a particular dynamic related to the rural activities of forest and Brazil nut extraction.

With respect to the study carried out (GOREMAD 2010), the population centers in the province of Tahuamanu have been differentiated by volume from the existing population, between:

- 150 - 300 inhabitants, comprising the towns of San Lorenzo, Shiringayoc, La Novia, San Pedro, Villa Rocío,
- 301 - 600 inhabitants, comprising the Flor de Acre population centers,
- 601 - 1000 inhabitants, includes the towns of Iñapari, Pacahuara, Alerta.

- 1001 - 6000 inhabitants, including the population centers, Iberia.

Likewise, spaces with a dispersed population (less than 150 inhabitants) have been identified among them: Bélgica, Villa Primavera, Chilina Vieja, Tropezón, Nuevo Pacarán and Santa María. Finally, there are some populations that, depending on the physical and climatic conditions, are isolated as Oceania, San Francisco de Asís and Portillo. One of the causes is the difficulty of navigation that exists in the low season, on the other hand, in the rainy season, the routes of penetration and/or access are impassable, leaving these populations isolated and uncommunicated with the rest of the province.

POPULATION

For the region of Madre de Dios, the last census conducted (Census 2007) registered 109,555 inhabitants (0.40 percent of Peru's total population), composed of 54.31 percent men and 45.69 percent women. Of this population, 73.30 percent was located in urban areas and 26.70 percent in rural areas.

TABLE 10: POPULATION BY AGE GROUP BY DEPARTMENT/PROVINCES, GENDER AND URBAN/RURAL AREA

Department, Province, Urban and Rural area, gender and type of housing	Total	LARGE AGE GROUPS (in years)					
		Less than 1	1 to 14	15 to 29	30 to 44	45 to 64	65+
Department MADRE DE DIOS	109,555	2,489	31,934	34,671	24,380	13,178	2,903
Men	59,499	1,249	16,233	18,084	13,850	8,309	1,774
Women	50,056	1,240	15,701	16,587	10,530	4,869	1,129
URBAN	80,309	1,841	24,212	24,861	17,828	9,624	1,943
Men	41,875	922	12,306	12,225	9,492	5,819	1,111
Women	38,434	919	11,906	12,636	8,336	3,805	832
RURAL	29,246	648	7,722	9,810	6,552	3,554	960
Men	17,624	327	3,927	5,859	4,358	2,490	663
Women	11,622	321	3,795	3,951	2,194	1,064	297
Province TAMBOPATA	78,523	1,808	23,568	24,394	16,899	9,673	2,181
URBAN	65,444	1,514	19,887	20,375	14,130	7,932	1,606
RURAL	13,079	294	3,681	4,019	2,769	1,741	575
Province MANU	20,290	483	5,653	7,146	4,729	1,957	322
URBAN	7,261	185	2,391	2,160	1,725	695	105
RURAL	13,029	298	3,262	4,986	3,004	1,262	217
Province TAHUAMANU	10,742	198	2,713	3,131	2,752	1,548	400
URBAN	7,604	142	1,934	2,326	1,973	997	232
RURAL	3,138	56	779	805	779	551	168

Nominally registered population

Source: INEI - National Census 2007: XI of Population and VI of Housing

The Madre de Dios region is divided into three political-administrative provinces: Tambopata, Manu and Tahuamanu. The province of Tambopata has four districts: Tambopata, Inambari, Las Piedras and Laberinto; this province has 78,523 inhabitants (representing 71.67 percent of the total population of Madre de Dios) of which 52.76 percent are men and 47.24 percent are women. The province of Manu has four districts: Manu, Fitzcarrald, Madre de Dios and Huepetuhe; this province has a total of 20,290 inhabitants (representing 18.52 per cent of the total population of Madre de Dios) of which 57.27 percent are male and 42.73 percent are female. The province of Tahuamanu has three districts: Iñapari, Iberia and Tahuamanu; this province has a total of 10,742 inhabitants (representing 9.81 percent of the total population of Madre de Dios) of which 60.03 % are male and 39.97 percent are female.

The population of the project area totals 10,742, of which 62.51 percent is concentrated in the Iberia district, especially in the urban population center of the same name.

TABLE 11: POPULATION BY AGE GROUP BY PROJECT LOCATION DISTRICTS, GENDER AND URBAN/RURAL AREA

District and Gender	Total	%	LARGE AGE GROUPS (in years)					
			Less than 1	1 to 14	15 to 29	30 to 44	45 to 64	65+
District IÑAPARI	1,288	11.99	26	385	361	313	159	44
Men	711	55.20	11	183	207	175	110	25
Women	577	44.80	15	202	154	138	49	19
District IBERIA	6,715	62.51	124	1663	1964	1729	979	256
Men	4,049	54.45	72	852	1145	1149	672	159
Women	2,666	45.55	52	811	819	580	307	97
District TAHUAMANU	2,739	25.50	48	665	806	710	410	100
Men	1,688	61.62	20	329	469	496	300	74
Women	1,051	38.38	28	336	337	214	110	26
TOTAL	10,742	100	1,680	22,257	22,545	15,621	9,027	2,094
%	100.00		2.29	30.40	30.79	21.33	12.33	2.86

Source: Nominally registered population. Source: INEI - National Censuses 2007: XI of Population and VI of Housing.

One of the characteristics of the population of Madre de Dios and, therefore, of the project, is its high population mobility caused mainly by the expectation of working in mining (an expectation that is increasing due to the constant rise in the price of gold) and by the demand to take advantage of the

region's forest and agricultural resources. At the departmental level, migration due to the expectation of working in mining or in the services and businesses that are sustained by this activity, are the main causes of the increase in population. Migrants enter Madre de Dios from other regions, mainly from the Andes.

TABLE 12: MIGRATION BY TIME PERIODS IN MADRE DE DIOS (in %)

Period	Internal Migration	Output	Input	Net Migration
2002-2007	4.2	6.3	21.1	14.8
1988-1993	3.9	13.1	21.7	8.6
1976-1981	9.1	2.3	-6.8	24

Source: Yamada 2010

This feature makes the Madre de Dios department (as part of Peruvian internal migration) ranked first in net migration in 2007. "The department that relatively attracted the majority of the population was Madre de Dios (in the Jungle), with a net migration balance of 14.8 percent (a very high rate of 21.1 percent, corresponding only partially offset by 6.3 percent departures)" (Yamada 2010).

TABLE 13: MIGRATION TO MADRE DE DIOS COMPARED WITH OTHER REGIONS (in %)

Region	Internal Migration	Output	Input	Net Migration
Madre de Dios	4.2	6.3	21.1	14.8
Lima	1.7	3.4	8.0	4.6
Tacna	8.1	5.7	10.2	4.5
Callao	0.0	8.7	13.1	4.4
Tumbes	2.0	6.7	9.6	2.9

Source: Yamada 2010

As of 2007, with the Madre de Dios department as the residence department, the following migration type data are available: 45.3 percent non-migrants, 28.6 percent of established migrants, 26.1 percent of migrants in the last five years, 50.6 percent of primary migrants, 35.6 percent of regular migrants and 13.8 percent of return migrants (2007 Census).

SOCIO-ECONOMIC PROFILE

By 2007, 39.3 percent of the country's population was in poverty, that is, had insufficient spending to purchase a basic consumption basket. Of the 39.3 percent of poor people in the country, 13.7 percent are extremely poor, that is, they have per capita spending below the cost of the basic food basket, and 25.6 percent are non-extreme poor, with per capita spending above the cost of the food basket, but below the value of the basic consumption basket.

The main indicators of poverty in the project districts are presented in the following table, showing that the Iñapari and Iberia districts have 26 percent and 20 percent of the much smaller rural population respectively

compared to 54 percent in Tahuamanu district. The Madre de Dios department has 27 percent rural population, and Peru has 24 percent.

This inequity is reflected and reinforced in the other indicators such as the population without water which is 6 percent for Iñapari and 14 percent for Iberia compared to 48 percent recorded for the district of Tahuamanu being an even higher percentage than that recorded for the department of Madre de Dios (20 percent) and Peru (23 percent).

The indicator of population without drainage or latrine is led by the district of Iñapari with 24 percent, followed by the district of Iberia with 10 percent close to 8 percent of the district of Tahuamanu. With respect to the indicator of population without electricity is 57 percent in the district of Tahuamanu, 37 percent in Iñapari and 24 percent in Iberia. The indicators for illiterate women, children aged 1-12 years and malnutrition rate for the three districts were close.

TABLE 14: KEY POVERTY INDICATORS IN MADRE DE DIOS BY DISTRICTS

POVERTY INDICATORS MADRE DE DIOS REGION - FONCODES DISTRICT POVERTY MAP 2006, WITH INDIC. ACT. WITH 2007 CENSUS									
Province and district	Population 2007	% Rural Pop.	Quintile [15]	% population without water	% population without letter / drainage	% population without electricity	% illiterate women	% children 0-12 years	Malnutrition rate Children 6-9 years
Peru	27'428,169	24		23	17	24	11	26	22
Madre de Dios	109,555	27	3	20	19	31	5	27	13
Prov. Tahuamanu	10,742	29	2	22	11	34	6	23	12
Iñapari	1,288	26	2	6	24	37	6	27	10
Iberia	6,715	20	2	14	10	24	6	23	12
Tahuamanu	2,739	54	2	48	8	57	7	22	12

Source: Poverty map 2006, FONCODES.

On the other hand, for the Madre de Dios region, in the 2005-2007 period, economic participation indicators such as the EAP (the economically active population (EAP) includes all persons of either sex who contribute their work to produce economic goods and services) were 72.0 per cent, 74.9 per cent and 78.1 per cent respectively. As an occupation category, the percentage of wage earners increased slightly (31.9 percent, 33.9 percent and 36.2 percent), and there was a notable increase in unpaid family workers (22.0 percent, 21.0 percent and 35.7 percent).

For the project districts, the 2007 Census records a district average of 58.01 percent occupied EAP and 1.49 percent, unoccupied ADP. The Madre de Dios region registers 52.43 percent of occupied EAP and 1.51 percent of unoccupied EAP. It is worth noting that this same census registers 22.27 percent (2,392 people) of non-EAP (non-EAP is the population of working age, but who, in the adopted reference period, did not carry out or seek to carry out any economic activity) for the province of Tahuamanu, being almost half of the regional average of 46.06 percent of non-EAP.

TABLE 15: KEY ECONOMIC INDICATORS BY STATUS OF POVERTY IN MADRE DE DIOS 2005-2007

[15] 1/: Quintiles weighted by population, where 1 = Poorest and 5 = Less Poor

Variables and Indicators	2005			2006			2007		
	Total	Poor	No Poor	Total	Poor	No Poor	Total	Poor	No Poor
Participation in economic activity									
Activity condition (%)	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
EAP	72,0	67,3	73,7	74,9	71,5	75,7	78,1	68,9	79,4
NO EAP	28,0	32,7	26,3	25,1	28,5	24,3	21,9	31,1	20,6
Occupation category (%)	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
Employer	11,6	6,8	13,1	12,2	6,0	13,4	12,9	11,1	13,1
Salaried	31,9	22,5	34,9	33,9	24,9	35,7	36,2	36,6	36,1
Self-employed	34,4	42,8	31,9	32,9	35,4	32,4	17,3	32,6	33,7
Unpaid family worker	22,0	28,0	20,1	21,0	33,6	18,5	35,7	19,7	17,0
Economic sector (%)	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
Primary (%)	35,7	56,7	29,2	32,6	64,1	26,3	38,6	63,3	35,6
Secondary (%)	5,3	4,2	5,7	6,8	4,4	7,3	8,9	5,1	9,4
Tertiary (%)	58,9	39,1	65,1	60,6	31,4	66,4	52,4	31,6	55,0
Income and expenses									
Monthly per capita income (nuevos soles)	353,0	144,9	445,7	435,0	173,5	507,8	480,5	196,5	533,0
Monthly expense per capita (nuevos soles)	313,2	145,0	388,2	373,8	156,3	434,3	404,9	164,6	449,3

Source: INEI-National Household Survey (ENAHO) 2005-2007.

TABLE 16: ECONOMIC ACTIVITY OF THE POPULATION BY PROJECT LOCATION DISTRICTS

Economic Activity of the Population (EAP)	Dist. Iñapari		Dist. Las Piedras		Dist. Tahuamanu		Madre de Dios	
Categories	Cases	%	Cases	%	Cases	%	Cases	%
Occupied EAP	670	59.55	3,376	56.45	1,495	61.12	49,712	52.43
EAP Unoccupied	31	2.75	92	3.08	20	0.81	1,428	1.51
No EAP	424	37.70	1,037	40.47	931	38.07	43,668	46.06
Total	1125	100.00	5,981	100.00	2,446	100.00	94,808	100.00
NSA	163		734		293		14,747	

Source: INEI, 2007

This economic population is associated with various economic activities, mainly gold mining, traditional monoculture agriculture, timber and Brazil nut extraction, livestock and small animal husbandry. The population of the rural zone is mainly made up of former residents and migrants with more than fifteen years in the zone, dedicated to monoculture agriculture, hunting, fishing, Brazil nut gathering, wood extraction, and seasonal artisanal mining and small businesses (wineries, restaurants, bars, lodges, others) (Lourdes Fernandez 2009).

In the Department of Madre de Dios, the Gross Domestic Product increased by 13.6%, mainly due to the growth of the activity of oil, gas, minerals and related services (25.6%), which represents 52.5% of the

departmental GDP; and by the activities: construction (16.1%), telecommunications and other information services (10.3%), public administration and defense (8.3%), and lodging and restaurants with 5.8%. In particular, the extraction of minerals and related services in 2016 recorded an increase of 32.5% in the gross value added of the activity as compared with the previous year because of the greater production of gold ore in fine Grams of 38.0%. (INEI, 2017)

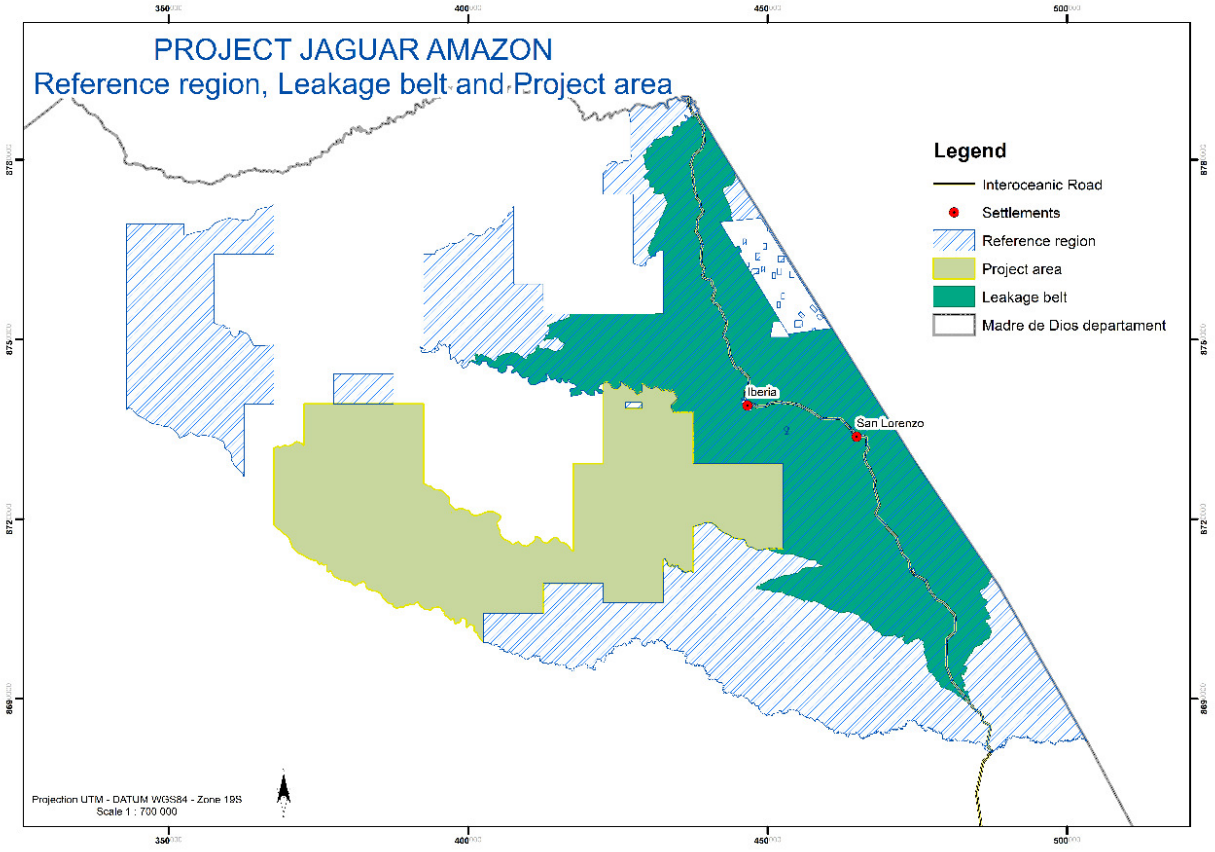
TABLE 17: GOLD PRODUCTION IN MADRE DE DIOS, 2015-2016

Product	Unit of measure	2015	2016	Var. (%)
Gold	Grs. F.	12 730,632	17 569,475	38.00

Source: INEI, 2017

2.1.7 Project Zone Map (G1.4-7, G1.13, CM1.2, B1.2)

MAP 7: PROJECT ZONE (RR, PA & LB)



A table with the geodetic characteristics of each one of the key areas: reference region, leakage belt and project area is also presented below:

MAP 8: PROJECT AREA AND SURROUNDING COMMUNITIES

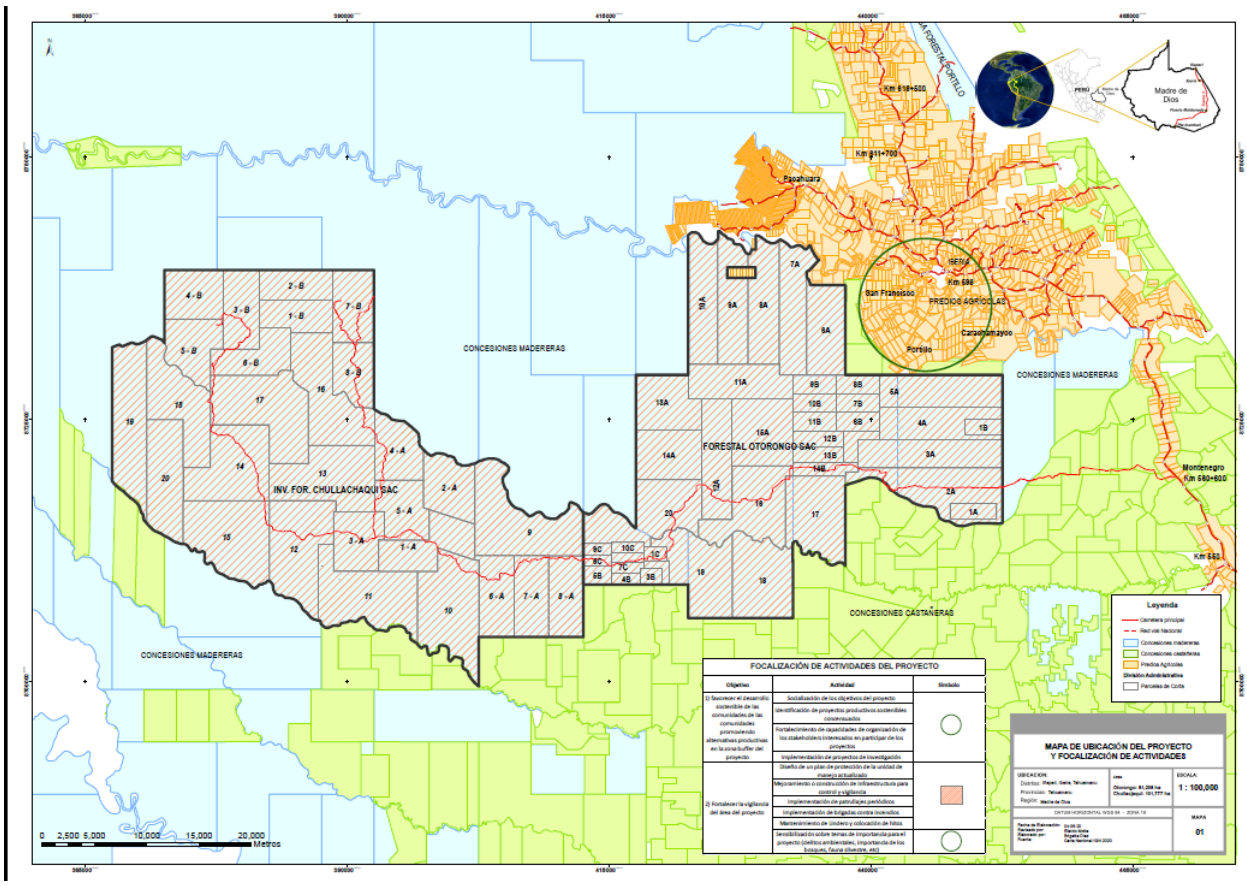


TABLE 18: GEODETIC CHARACTERISTICS OF PA, RR AND LG

Entity	Project Area	Reference Region	Leakage Belt
Centroid X	407287	447623	452331
Centroid Y	8721397	8702255	8736370
Latitude	11° 33' 54.165" S	11° 29' 13.894" S	11° 25' 50.560" S
Longitude	69° 51' 1.011" W	69° 35' 48.212" W	69° 26' 12.552" W
Area (ha)	183,015.29	516,554.22	232,114.34
Tenure	Forest concessions	Forest concessions, agrarian plots, BN concessions	Forest concessions, agrarian plots, BN concessions
Department	Madre de Dios	Madre de Dios	Madre de Dios
Province	Tahuamanu	Tahuamanu	Tahuamanu
District	Iñapari - Tahuamanu - Iberia	Iñapari - Tahuamanu - Iberia	Iñapari - Tahuamanu - Iberia

TABLE 19: PRESENCE OF HIGH CONSERVATION VALUES IN PROJECT AREA

HCV		Result
1	Significant concentrations of biodiversity values at global, regional or national levels	Present
2	Globally, regionally or nationally significant large forests on a landscape scale	Present
3	Forest areas within or containing rare, threatened or endangered ecosystems	Not present
4	Forest areas that provide basic ecosystem services in critical situations	Not present
5	Forest areas essential to meet the basic needs of local communities	Not present
6	Forest areas critical to the traditional cultural identity of local communities	Not present

The geodetic coordinates of the polygon of the project area, leakage belt, reference region and key surrounding communities and towns are included in a KML file attached.

2.1.8 Stakeholder Identification (G1.5)

The process of stakeholders' identification is based on the consideration of following criteria:

- Social relevance: especially neighboring social groups (communities, producers, etc.)
- Technical relevance: especially entities who have a key role related with forests and forest resources
- Political relevance: especially administrative authorities at a local, regional or national level
- Economic relevance: here are included the type of actors that develop a similar activity than the project proponent and in the surrounding area as potential synergies may occur

2.1.9 Stakeholder Descriptions (G1.6, G1.13)

Communities, as defined in the CCB standard, it means a group of persons that obtain their incomes, ways of subsistence and cultural value, from the project area are not present in this project. The project area has been a forest concession since many decades ago so no customary uses are being restricted by the implementation of the project. Actually, most of neighbors are migrants from highlands.

Even though that, the current stakeholder analysis has been done following the guidelines of CCB, "Social and Biodiversity Impact Assessment"

TABLE 20: STAKEHOLDER IDENTIFICATION

Stakeholder	Rights, Interest and Overall Relevance to the Project
Rural producers	Right: They do not have the right to occupy forest concessions to install their crops or cattle. In Peru, almost all deforestation is illegal Interest: To get enough incomes for livelihood, mainly from their traditional activity, agrarian production

	Relevance: High because depending on how they produce crops, they may need or not to expand to new areas, mostly recently cleared forest areas
Local municipalities	Right: They have competences referred to land planning at its province or district level, among others Interest: To promote the development of their jurisdiction and welfare of their citizens Relevance: Depending on the point of view of the political party of the municipality, they may have different positions and actions with the forest. They are subject to pressure from citizens and migrants for new urban areas to live or develop agrarian activities.
Religious community	Right: They do not have the right to occupy forest concessions to install their crops or cattle. In Peru, almost all deforestation is illegal Interest: Because of their beliefs, they think the land is to be worked (what is understood as agrarian production) so they are expanding very quickly the agrarian frontier Relevance: Very relevant because they are putting a lot of pressure on neighboring forest areas
SERFOR	Right: The national forest authority is in charge of promoting sustainable forest management. Interest: To value the forest heritage and resources as a strategy for its conservation. Relevance: It could be a good partner for strategies to reduce forest loss rate in the project area and surrounding forests.
Regional Government	Right: The mission of the regional governments is to promote the sustainable integral development, promoting public and private investment, and employment, guaranteeing the rights and equal opportunities of its people, as indicated in the national and regional plans and programs. Interest: To attract private investment that creates local employment in order to achieve a good social environment than ensures interesting political capital Relevance: Many forest functions have been transferred from national government to regional entities as the Forest Directorate (GERFOR) so it plays a role (that may be a facilitator or an obstacle) in the development of forest concessions
Forest concessions	Right: They have the right to sustainably exploit their concession forest area. Interest: They are under growing pressure from deforestation drivers and illegal loggers so a positive experience as JAGUAR REDD PROJECT may be an incentive to develop similar projects Relevance: They can be good allies of the project as a model forest cluster can become a barrier of deforestation expansion
Ministry of Environment	Right: As the climate change authority, MINAM has the function to promote actions to reduce GHG emissions, including from land use change. Interest: The reduction of deforestation rate is key for MINAM to achieve its NDC targets but rules about how to share reductions between government and private sector are pending of definition. Relevance: Very high because it defines many of the rules key for REDD+ projects
OSINFOR	Right: It has the function to supervise and ensure the accomplishment of sustainable management of forest resources and punish crimes against forest heritage

	Interest: The conservation of forest heritage Relevance: High because it plays a key role in the surveillance and sanction to illegal activities that affect forest cover and forest resources

2.1.10 Sectoral Scope and Project Type

The current AFOLU project is classified as a REDD+ project, mainly a reduction of deforestation project. This is not a grouped project.

2.1.11 Project Activities and Theory of Change (G1.8)

There are no jurisdictional REDD+ programs in Peru. In the following table, using The Project Activities and Theory of Change Table of Appendix 2, the JAGUAR REDD+ Project develops its production-protection approach based on three axes:

1. PRODUCTION COMPONENT
   - 1.1. Identification of productive projects in the surrounding communities. The projects will be selected in agreement with local settlements in order to ensure the appropriateness of the initiatives to be supported by the community groups who will implement and have the ownership on the initiatives.
   - 1.2. Capacities strengthening of stakeholders' organizations. The success of the productive initiatives depends on the strengthening of capacities. They include technical, entrepreneurial, organizational and commercial capacities, which are key to help them to achieve successful products.
   - 1.3. Promotion of sustainable productive projects. With those two enabling conditions, this is the implementation of productive projects previously selected and trained. The training will be done simultaneously but a pilot scale and then, at this moment, it will scale up.
   - 1.4. Implementation of research projects. As a complement to the productive activities, research is required to improve techniques, include new raw materials and processes and develop new byproducts for the market in order to maximize the value obtained from the productive activities.

2. PROTECTION COMPONENT
   - 2.1. Design of a protection plan of the project area. An integrated protection plan of the boundaries of the forest concessions in order to diminish the risk of occurrence of illegal activities as land clearance, illegal logging, forest fires, among others. The plan should include the building or improvement of control infrastructure in key sites and a patrolling strategy by combined brigades.
   - 2.2. Building / improvement of control and surveillance infrastructure. One of the components of the protection plan is the building of new infrastructure (control and surveillance posts) or the improvement of existing one.
   - 2.3. Periodical patrolling. The objective of this patrolling is to identify anthropogenic actions that cause GHG emissions as deforestation for agrarian or settlement purposes or degradation as illegal logging.
   - 2.4. Forest fire prevention patrolling. The difference between this patrolling and the previous one is that this one has the purpose to early detection of fires caused mainly by neighboring agrarian plots that could get out of control and affect within forest concession.

2.5. Land demarcation, border maintenance and signaling. The 100% of concession borders will be earmarked with milestones. Those milestones will be periodically renewed to maintain good quality and will be complemented with signaling indicating clearly to foreigners where the concession starts and what is forbidden to do inside it.

3. GOVERNANCE COMPONENT

3.1. Socialization of REDD+ project. Meetings with public and private stakeholders including municipalities, local leaders, producers' organizations, schools among others. The objective is to explain the role of REDD+ project and its positive impacts on different issues especially climate change.

3.2. Dialogues about environmental crimes and legal framework. The purpose of these meetings is to share and train about legal framework related to forests, emphasizing the types of environmental crimes and the sanctions associated with each one.

TABLE 21: THEORY OF CHANGE OF THE PROJECT

Activity description	Expected climate, community, and/or biodiversity			Relevance to project's objectives
	Outputs (short term)	Outcomes (medium term)	Impacts (long term)	
1.1 Identification of productive projects in the surrounding communities 1.2 Capacities strengthening to stakeholders organizations 1.3 Promotion of sustainable productive projects 1.4 Implementation of research projects	03 of productive projects implemented in neighboring communities 03 of workshops with 10 of local families attendances 01 of researches supported	50% of net incomes increased, measured in annual average per-capita incomes	Neighboring families dedicated to sustainable productive activities reduce the need to expansion of agrarian frontier	The development of sustainable sources of incomes for local population will reduce their need to clear new forest lands for unsustainable agrarian production
2.1 Design of a protection plan of project area 2.2 Building / improvement of control and surveillance infrastructure 2.3 Periodical patrolling 2.4 Forest fire prevention patrolling 2.5 Land demarcation, border maintenance and signaling	04 of new/improved control and surveillance control sites 01 of patrolling circuits per month 100% of borders of the concession with milestones	80% of illegal activities/forest fires detected while they were occurring as a percentage of total detected cases	Reduction of illegal activities and uncontrolled forest fires	The enhancement of land surveillance will increase the risk for illegal activities to be captured and, in consequence, the costs of doing those illegal activities
3.1 Socialization of the REDD+ Project 3.2 Dialogues about environmental crimes and legal framework	03 of workshops with 10 of local families attendances			An improved governance based on the dialogue with stakeholders will contribute to collaborative relationships with neighbors

2.1.12 Sustainable Development

The project contributes to many international and nationally stated sustainable development priorities as:

- SDG. The current project contributes directly with at least two of the Sustainable Development Goal, which are: SDG 15: Life of terrestrial ecosystems, specially forests and its biodiversity; and SDG 13: Action for climate, because it expects to reduce GHG emissions from forest cover change caused by deforestation, that the project expects to prevent or reduce significantly.
- Bicentennial Plan. This is a planning tool, developed by Peruvian Government, with the purpose to define the priorities for the coming 200 years of Peru Independence. It has six strategic axes, being the sixth "Natural Resources and Environment".
- Forest and Wildlife Law, approved in 2016, has the goal to promote the conservation, protection, increase and sustainable use of forest and wildlife heritage within national territory, integrating the management with the maintenance and enhancement of forest ecosystem services and other ecosystems. Clearly JAGUAR PROJECT is on the same line that this law.
- National Strategy on Forest and Climate Change: The National Strategy on Forest and Climate Change (ENBCC, as its acronyms in Spanish) is the Peruvian REDD+ Strategy. It includes eight strategic lines. One of them refers to the "increment of the value of natural forests" including the sustainable forest management (as JAGUAR PROJECT is).
- NDC. Peru has also updated its Nationally Determined Contributions as the country contribution to climate targets as established in Paris Agreement. One of the Mitigation Measures in the LULUCF sector is also "Sustainable Forestry Management" with a target of 4.1 million of hectares that the government commits to promote in order to achieve the management of the area.
- Axes to fight against deforestation. Launched by the Ministries of Agriculture, Environment and Energy, is based on four axes, one of them referred to "sustainable production".

2.1.13 Implementation Schedule (G1.9)

TABLE 22: MILESTONES OF THE REDD+ PROJECT

Date	Milestone(s) in the project's development and implementation
2002	Issuing of forest concession contract
2011	Otorongo FSC Certification
2017	Chullachaqui FSC Certification
2017	Agreement between project proponent and GREENOXX
2018	Starting Date of GHG accounting period
2020	Expected first verification audit
2021	Nesting year
2057	Ending date of REDD+ project

2.1.14 Project Start Date

November 8th, 2017 is the project start date in order to meet with a new forest cycle and to be comparable with official forest loss maps provided by MINAM, through GEOBOSQUES platform. The FSC certificate obtained by the Otorongo concession started on 8 November 2017, while the transfer of the two smaller

forest concessions to Otorongo also occurred in 2017. With both achievements, the forest area has consolidated in a contiguous managed area and with the FSC certification, the guarantee of sustainable management has been confirmed by an independent audit team. Forest certification is considered the milestone for the project start date not only because it ensures that the forest is being well managed environmental and socially, under independent international recognized standards (in a contiguous area that facilitates the logging and transportation stages and the patrolling of borders) but also because it, with the extra incomes of carbon sales, ensures financially the operations as certified timber allows the access to more attractive market niche.

2.1.15 Benefits Assessment and Crediting Period (G1.9)

January 1st, 2018 is the project crediting period start date and it lasts until December 31, 2041, the previous year of the end of the concession contract, even though the same contract states that it is renewable automatically every 5 years.

2.1.16 Differences in Assessment/Project Crediting Periods (G1.9)

There are no differences between the GHG emissions accounting, climate adaptive capacity and resilience, community, and/or biodiversity assessment and periods.

2.1.17 Estimated GHG Emission Reductions or Removals

Note: Estimations in this section are preliminary and subject to confirmation during first verification stage.

TABLE 23: ESTIMATED GHG EMISSION REDUCTIONS

Year	Estimated GHG emission reductions or removals (tCO2e)	Year	Estimated GHG emission reductions or removals (tCO2e)
2018	1,314,144.03	2025	2,885,719.19
2019	1,482,224.42	2026	3,198,876.62
2020	1,678,199.42	2027.	3,386,432.20
2021	1,825,981.93	Total estimated ERs	22,729,050.53
2022	2,056,803.83	Total number of crediting years[16]	10
2023	2,311,947.57	Average annual ERs	2,272,905.05
2024	2,588,721.33		

2.1.18 Risks to the Project (G1.10)

[16] The project expects to issue credits until 2041 but the baseline has been estimated only for the first 10 years until 2027 and results since 2021 are provisional until the governmental nesting process is completed and new rules become valid.

The Project has identified four major risks that must be faced in order to minimize the risk of occurrence and, if they happen, mitigate their impacts.

This analysis has been done using The Project Risks Table of Appendix 3 of VCS PD template and is presented below:

TABLE 24: PROJECT RISKS

Identified Risk	Potential impact of risk on climate, community and/or biodiversity benefits	Actions needed and designed to mitigate the risk
Productive activities are not enough attractive to change the pattern of land use of agrarian neighbors	Negative impacts on climate benefits because producers will continue pressing for agricultural lands inside of project area	Design feasibility study and provide continuous technical assistance including accompanying commercial activities in order to access to improved and specialized markets with premium prices
New migrants that are not part of the original beneficiaries of the REDD+ project will become new deforestation drivers as they do not participate in the project activities	Negative impacts on climate benefits because migrants won't receive the benefits of REDD+ projects and will search for lands inside of project area to settle and produce	Work jointly with authorities to a planning process of settlements of new migrants
Internal conflicts within local settlements	Negative impacts on community benefits as the conflicts will not allow access to activities offered as part of REDD+ project. As a consequence of that, they will press on project area or leakage belt	Work jointly with local leaders and social specialists in order to understand the expectations, interests and power groups and networks inside local communities
Fires cannot be controlled because of dry seasons	Negative impacts on climate and biodiversity benefits because it will cause forest loss affecting fauna and emitting GHG	Incorporate scientific and research information in the forest fires patrolling strategy

2.1.19 Benefit Permanence (G1.11)

Based on risk analysis, the measures proposed to guarantee the permanence of climate, community and biodiversity benefits are:

- Develop feasibility studies of products that will be produced with the support of REDD+ project in order to analyze previously if the activity is profitable enough to convince producers to dedicate to these activities instead of looking for new areas to produce conventional crops
- Provide a permanent technical assistance to producers including marketing aspects as part of a strategy to access to premium markets
- Support local and regional authorities urban planning process in order to reduce the risk of uncontrolled migration

- Implement a diagnosis of local relationships inside each community as part of the strategy of sharing benefits and activities at an equitable way to minimize the risk of internal conflicts that affect the project development
- Identify scientific sources of information related with intensity and location of forest fires and incorporate that information in patrolling strategy

2.1.20 Financial Sustainability (G1.12)

Annex 2 shows the cash flow of the operation in two scenarios: with REDD+ project (incomes and activities) and without REDD+ project. The results show that with the REDD+ project, the Net Present Value (NPV) increases from US$ 4.5 million to US$ 5,6 million, which is an increment of 22%.

The financial analysis has been conservative as it is assuming incomes from carbon sales of US$ 2 million in the first year and US$ 840 thousand, the next six years. Last three years, sales from first baseline period are not expected. This is because the first year, the verification process will include three vintages (2018-2020). It must be remembered that JAGUAR PROJECT has a partner as GREENOXX, who has a proven history of marketing success and presence in carbon markets. Price used is obtained from average sales of GREENOXX from other Peruvian REDD projects. Volumes are obtained from the current PD.

The analysis has included ten years. Regarding timber sales, the assumptions are based on the many years of experience of FORESTAL OTORONGO. Price has been supported with sales contracts for the timber with the less level of transformation, which is round wood, in order to be conservative. Timber volume has been obtained from the project proponent harvest balances (Balances de Extracción) approved by forest authorities.

Regarding costs associated to timber extraction, they include cutting, dragging, transportation, road maintenance, machinery and equipment maintenance, forest planning. Also, forest certification, legal fees, monitoring, forest protection, post-harvest management are included. These costs have been obtained from historical records in our accounting system, officially reported to the National Tax Office. Regarding labor costs, these have been also collected from the official information provided to the Ministry of Labor.

They are also based on large experience of decades dedicated to this productive activity while costs associated to carbon business are also based carbon credits generation (design, certification, registry, issuance and other fee). Financing the implementation of REDD+ project activities (patrolling and monitoring, productive project promotion, training, research, delimitation, among others) and community and biodiversity monitoring.

Regarding the discount rate used to calculate the NPV, the cash flow has worked with a discount rate of 10%. This value has been obtained from an independent research, developed by “EQUBO Financial Advisor”, who valuated the companies of Bozovich Group and which recommended an interval between 9 and 13% as an adequate value for the discount rate. This is a sensitive information, so it will be shared with audit team directly.

2.1.21 Grouped Projects

This is not a grouped project.

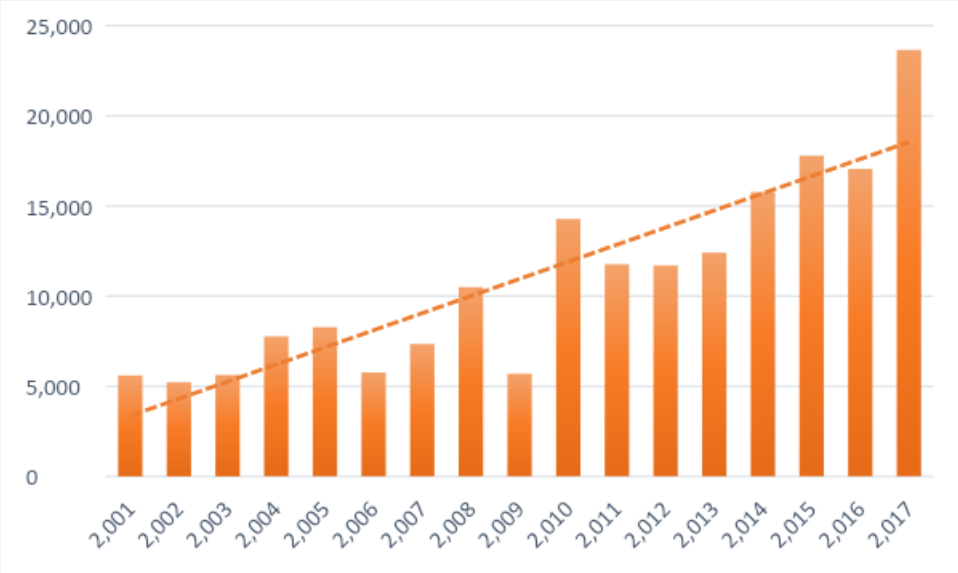
2.2 Without-project Land Use Scenario and Additionality

2.2.1 Land Use Scenarios without the Project (G2.1)

Madre de Dios was a pristine region and for this reason, it was the capital of biodiversity until 2009, when the Interoceanic Highway was finally completely paved and the transportation cost reduced dramatically, increasing exponentially the internal migration from the highlands of Peru.

This is the reason why Madre de Dios shows an exponential increase of the deforestation rate since that year as can be seen in following chart:

CHART 1: DEFORESTATION TREND IN MADRE DE DIOS (2001-2017)

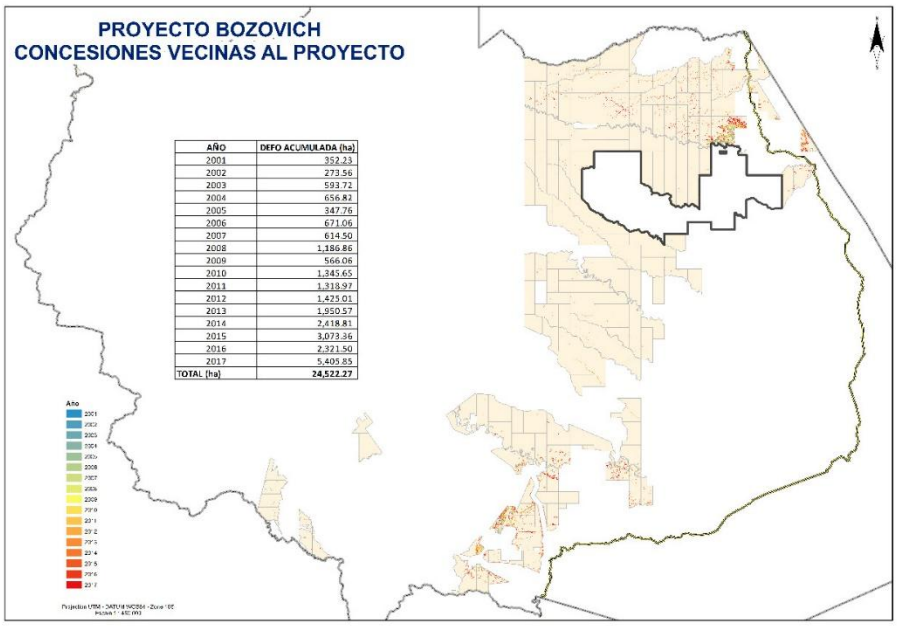


Source: GEOBOSQUES (MINAM)

Own elaboration

If we only take data since 2009, the slope of the trend is even higher. Migration is focusing on mining areas (in the south of Madre de Dios) and in agrarian activities (around both axes of IOH). Migration for agrarian purposes is putting a lot of pressure over forest concessions as may be seen in the map that shows all the timber concessions in Madre de Dios overlapped with deforested areas. Almost 25 thousands of hectares of timber concession have been deforested during this century (2001-2018), but 22% was lost only in the last year (2018) showing the growing threat that close forests face.

MAP 9: FOREST CONCESSIONS IN MADRE DE DIOS



As described in more detail in Community section 3.1.4), there are different settlements located in the surrounding areas to the concession. One of them, a religious community, is, according to the different interviews applied to local stakeholders (including the leaders of the other local communities), the most aggressive in terms of time dedicated to agriculture and agrarian frontier expansion. Newcomers may increase in the next years attracted by the lack of governance and the promotion of this activity by local authorities. It must be remembered that the major of the district is a member of this religious community.

The timber concession, basis of the REDD+ Project, was granted in 2002 but logging is a traditional activity in the zone since decades ago and the project proponent is a very well-known family in the forest sector in Peru and also in Madre de Dios.

Without the REDD+ incomes, FORESTAL OTORONGO will not be able to spend financial resources from its core business to implement a sustainable productive development program with families living in neighboring towns, now dedicated to agrarian production nor will be able to strengthen the patrolling system.

In that scenario, the most likely scenario is that agrarian production will enter into the forest concession as it is already happening in other smaller concessions that do not have the resources to protect as effectively as FORESTAL OTORONGO has done until now in theirs.

2.2.2 Most-Likely Scenario Justification (G2.1)

The most likely scenario described in 2.2.1 is proposed, based in two elements:

- Statistical data of increasing deforestation rate in similar type of land tenure, it means, other forest concessions, in the same administrative unit, Madre de Dios Region.

- Expert opinions from a diverse range of stakeholders (community leaders, forest authorities, etc.) about the profile of each local settlement and the trends on land use

2.2.3 Community and Biodiversity Additionality (G2.2)

Biodiversity is intrinsically connected with the climate targets. The reduction of GHG emissions from reduction of forest loss cause automatically the reduction of biodiversity loss as forests hosts many fauna and flora species that compose the rich biodiversity of the project area. This is described in more detail in the Biodiversity Section.

In the case of community additionality, the main positive impact will come from the support that FORESTAL OTORONGO will bring to neighboring communities, through productive projects, organizational strengthening and enhanced governance. At this time, since 2002 when the concessions started operations, timber incomes did not generate enough profits to be invested in this type of activities. This is based on evidence of more than 18 years. As shown in the cash flow, these investments come from a fraction of expected carbon sales.

2.2.4 Benefits to be used as Offsets (G2.2)

At this time, FORESTAL OTORONGO nor GREENOXX plan to access any type of market for biodiversity offsets nor community offsets. This can be reviewed in the cash flow where incomes are originated only from the timber and carbon sales.

2.3 Stakeholder Engagement

2.3.1 Stakeholder Access to Project Documents (G3.1)

All the documentation referred to the REDD+ project, except sensitivity information (internal financial information as production costs, prices, clients, among others) will be available for public review, including communities and authorities, through two ways:

- Through the web page, where a link with all the information about the REDD+ Project will be created and stored
- Through a focal point in FORESTAL OTORONGO organizational chart of the Company, that will receive physically or via email, any request of information

The available information includes the project document and periodical monitoring reports, including biodiversity, community and climate reports. Referred to reports, an option to be analyzed is the participation of some delegates of communities and authorities in a special field monitoring action to develop capacities and confirm outcomes obtained.

In the following table, a summary of engagement process is briefly described with the evidence of these meetings in Annex 3:

TABLE 25: ENGAGEMENT PROCESS WITH STAKEHOLDERS

Stakeholder	Feedback received from stakeholder	How it was incorporated in the design	Evidence
Carachamayoc Community	Leaders and community families attended different meetings and workshops, where they had the opportunity to express their concerns and needs. Specifically, they requested for support in legal issues (as the new Forestry Law), tax framework, land titling and productive activities (especially agroforestry with cocoa)	Training on controlled fires were carried out. After an explanation about the REDD project, the project proponent and community leaders agreed to install a Grievance and Redress Mechanism pilot. Also the project proponent committed to support the community with the promotion of agroforestry initiatives in the community	January 2018 October 2020
Portillo Community	Leaders and community families attended different meetings and workshops, where they had the opportunity to express their concerns and needs. Specifically, they requested for support in legal issues (as the new Forestry Law), tax framework, land titling, productive activities (especially cattle ranching, agroforestry with cocoa), forest conservation and restoration with native NTFP species as aguaje, wasai, ungurahui (native palm trees)	After an explanation about the REDD project, the project proponent committed to support the community with the promotion of agroforestry initiatives in the community	January 2018 October 2020
San Francisco Community	Leaders and community families attended different meetings and workshops, where they had the opportunity to express their concerns and needs. Specifically, they requested for support in crop management, agroforestry, forest conservation, forestry law, land titling, vicinal road	Based on that feedback, the project proponent, not only included in project design the promotion of sustainable productive activities and the strengthening of boundaries patrolling, considering that roads may increase the risk of migration and invasions, but started to provide some technical workshops in partnership with specialized entities as IIAP and AAE. Workshops included topics as ecologic agriculture, soil conservation, organic fertilization and others After an explanation about the REDD project, the project	January 2018 March 2018 May 2018 October 2020

		proponent committed to support the community with the promotion of agroforestry initiatives in the community	
Research entities (IIAP, Iberia Institute)	Potential synergies were searched and established with educative and research entities for the implementation of mitigation actions to prevent or reduce the impact on deforestation	Coordination meetings to schedule trainings about controlled fires, cocoa production and others to local population Workshops were carried out about agroforestry and conflicts resolution and environmental crimes	July 2019 August 2019

In addition, other meetings to inform about COVID were given to workers, communities and other stakeholders as Brazil nut harvesters.

2.3.2 Dissemination of Summary Project Documents (G3.1)

In addition to previously described in 2.3.1, the project plans additional strategies to disseminate the information in a didactic manner:

- Periodical meetings with families from surrounding settlements
- Working groups with community leaders and local authorities to evaluate the development of the project activities
- Publishing materials

2.3.3 Informational Meetings with Stakeholders (G3.1)

A protocol for informational meetings with stakeholders will be developed during the first stages of the REDD+ project. The protocol will define, among others the following components:

- A minimum of previous time for call the meeting, in order to ensure that interested may organize and plan with enough anticipation their participation in the meeting
- A diffusion through adequate communication channels as local radios, information in communal auditoriums among others to be defined in a consensus with local authorities and leaders
- Executive summaries will be prepared in a simple language that may be understood by rural families, printed and shared during meetings
- At least one meeting per year will be carried out and there will be space for participation of local leaders and authorities as a balance of the activities of the current year and the proposals and planning of activities of the coming year

2.3.4 Community Costs, Risks, and Benefits (G3.2)

A qualitative methodology will be developed to estimate the potential costs, risks and benefits of the implementation of the REDD+ project.

As an example, the expected outputs could be some of these ones:

TABLE 26: COST-BENEFIT ANALYSIS OF EXPECTED OUTPUTS OF THE PROJECT

Expected Output of the implementation of the REDD+ project	Qualitative Cost or Benefit	Quantitative Cost or Benefit
Increased governance and forest monitoring against illegal activities that affect the forest		
Productive activities and capacities development supported by REDD+ project		
Enhanced local governance and participatory processes		
Conserved biodiversity and new rules to access to them		

The participants will be organized by type of stakeholders so each group will identify the types of costs and/or benefits associated or caused by the core activities of the project (qualitative analysis). Based on this identification, the participants will try to quantify the magnitude of cost and/or benefit of each concept identified at a certain time-period.

TABLE 27: RISK ASSESSMENT OF EXPECTED OUTPUTS OF THE PROJECT

Expected Output of the implementation of the REDD+ project	Type of risk that may occur	Degree of occurrence of that risk
Increased governance and forest monitoring against illegal activities that affect the forest		
Productive activities and capacities development supported by REDD+ project		
Enhanced local governance and participatory processes		
Conserved biodiversity and new rules to access to them		

At a second moment, the same groups will identify the type of unexpected negative situations that can affect the occurrence of expected outputs and then, they will discuss and agree the approximate percentage of probability that each risk can happen.

A summary of risks, costs and benefits, in Spanish, have been prepared (see Annexes) and the social responsible of Forestal Otorongo is organizing its socialization. The plan is to do it, at an initial stage, among the families interested in the REDD project in order to validate its functionality.

2.3.5 Information to Stakeholders on Validation and Verification Process (G3.3)

As indicated in 2.3.3, local radios and publications in community public places (where assemblies are carried out for example) and through local authorities and community leaders will be the main

communication methods to be used. This will be applied also in the CCB validation and verification processes.

The project will prepare an executive summary of the project and the process and will share. Previously to the visit, informational meetings will be organized in order to get the communities and stakeholders prepared for the audit visit and the project itself.

2.3.6 Site Visit Information and Opportunities to Communicate with Auditor (G3.3)

Communities and other stakeholders will have the opportunity to identify and select their own leaders that will act as contact points with the auditors. This information will be provided to the audit team and, as soon as a visit program is agreed, the agenda will be shared with these representatives. In any case, it should be with less than one week of anticipation.

Time must be separated for direct meetings between the audit team and these leaders, including local authorities. Those meetings may be joining different leaders in case time is limited for audit team. In the case, audit team does not speak Spanish, a translator will be considered for these independent meetings.

2.3.7 Stakeholder Consultations (G3.4)

Consultation with communities and other stakeholders has been done by collecting their expressions of interest about land use, which are reflected in a social diagnosis applied previously to the project design that is in annex 3. From this way, FORESTAL OTORONGO considers that the consultation process has been accomplished.

The influence of communities and other interested parties has been given through the expression of their interests about land use, reflected in a social diagnosis carried out previously to the project design. This is the way how the company has included the interest of the surrounding communities in the design of the project.

As communities did not know the project, those previous meetings were useful to inform about the project and they showed interest in the project and presented their proposals to improve livelihood in their communities.

2.3.8 Continued Consultation and Adaptive Management (G3.4)

FORESTAL OTORONGO has developed a feedback and grievance redress mechanism, which allows attending claims and suggestions. This system has been socialized between the surrounding communities and interested parties and, additionally, it has a permanent channel of communication with the company. The system ensures that any claim or suggestion is answered timely.

In addition, FORESTAL OTORONGO proposes meetings every 2 months with the directives and partners of each neighboring community and meetings with the Technological Institute of Iberia, promoting sport

activities and speeches for teamwork strengthening and trainings on environmental management and entrepreneurship.

2.3.9 Stakeholder Consultation Channels (G3.5)

Communication channels with surrounding communities and interested parties are open permanently. The company is in contact with their authorities and is informed about the changes in the Directives of the communities.

The company has developed introductory meetings with the presidents and directives with the neighboring communities. A permanent communication through social networks as WhatsApp groups with each neighboring community. During these meetings, parties discuss the development of potential joint activities.

2.3.10 Stakeholder Participation in Decision-Making and Implementation (G3.6)

Even though the interests of the communities and interested parties have been already considered in project design, the feedback process is permanent through the company's feedback and grievance redress mechanism.

The proposal is to develop participatory meetings with neighboring communities developing a space where they can make proposals of activities and they may participate in the execution of those activities.

2.3.11 Anti-Discrimination Assurance (G3.7)

The Project, through its institutional policy (annex 4), specifically in Section IV: Social Monitoring Policies, openly expresses respect for the rights of the communities, inhabitants and local third parties that could be affected by the development of Project activities or that are located in the area of influence. Likewise, Section VI: Personnel selection, hiring, promotion and training policies emphasizes the hiring of both qualified and unqualified local labor that meets the requirements of the position, in the same direction as regards the acquisition of goods and services (Section VIII). This instrument is socialized both to workers, providers of goods and services, and to our clients.

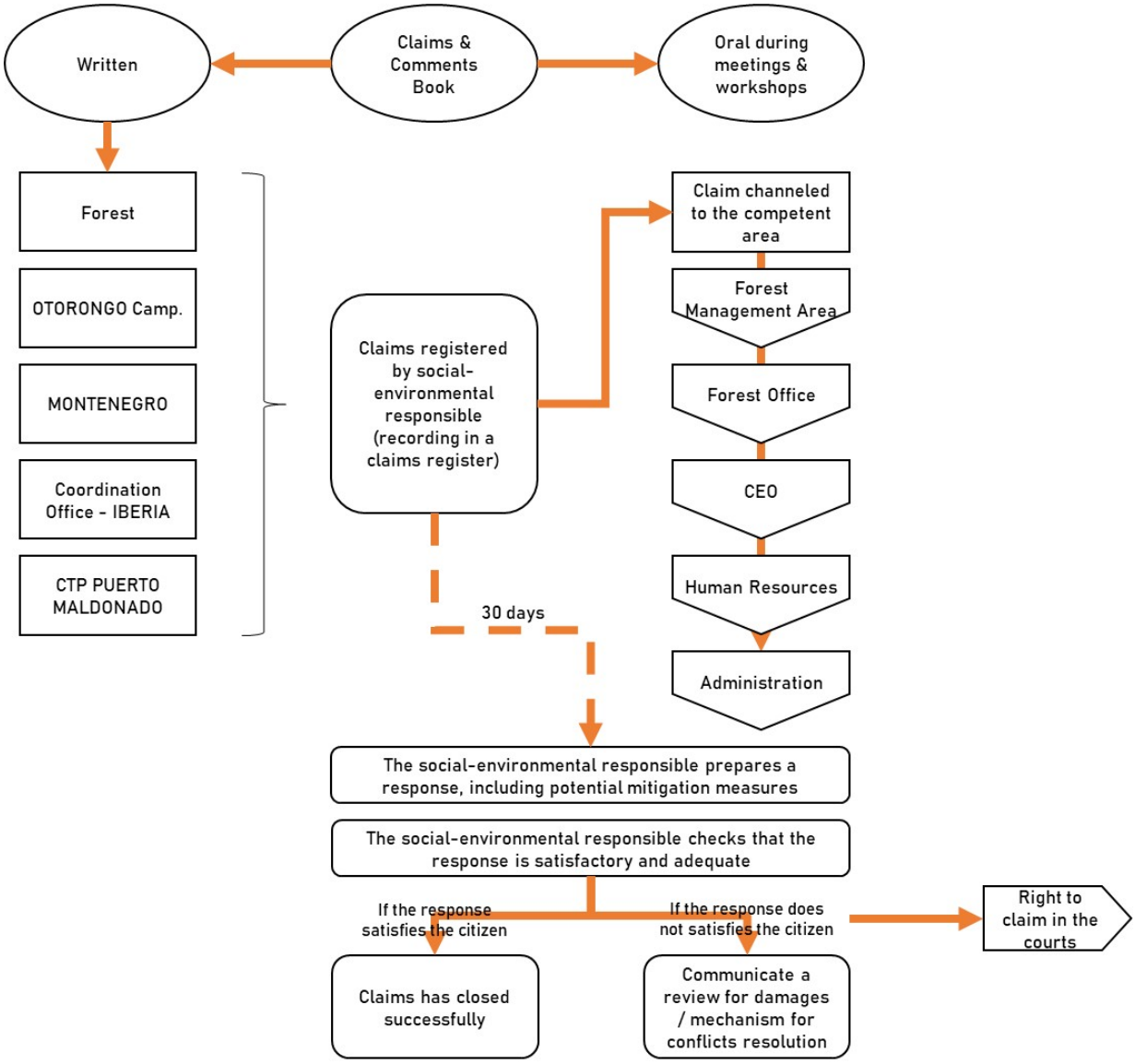
2.3.12 Feedback and Grievance Redress Procedure (G3.8)

The feedback and grievance redress mechanism (FGRM) is a tool to provide stakeholders an opportunity to raise claims about not accomplishment of agreements, wrong implementation of actions and projects, inaccurate sharing of benefits, among others.

For this reason, the way in which it is applied is critical because if it includes a complex or expensive method, it will not be accessible to rural families that are mostly the typical stakeholders of the surrounding area of the project.

Based on those considerations, the proposed FGRM is as follows:

CHART 2: PROCESS FLOW FOR FEEDBACK AND GRIEVANCE REDRESS MECHANISM



Own elaboration

The full process since the moment that the citizen has communicated his complain through one of the allowed mechanisms until the company provides the final responses will not last more than 30 days. In case, the citizen does not get satisfied with the solution adopted by the company, he is allowed to continue his complain through judiciary channels.

2.3.13 Accessibility of the Feedback and Grievance Redress Procedure (G3.8)

As described in the previous section (2.3.3 and others), the FGRM will be publicized by the same channels as other relevant information about the REDD+ project: the webpage, the local authorities and community leaders and public and community significant places or offices.

2.3.14 Worker Training (G3.9)

The Project's institutional policy (see annex 4) is to provide continuous training to workers, either individually or collectively, through workshops and talks based on specialized documents such as: forest safety regulations, internal work regulations, policies, forest certification, controlled logging, reduced impact logging, and others considered necessary by the Board of Partners. For example, Table 28 shows the training schedule and the topics addressed in 2019.

TABLE 28: TRAINING SCHEDULE 2019

	Tema de la capacitación 2019	Fecha	2019										
			Febrero	Marzo	Abril	Mayo	Junio	Julio	Agosto	Septiembre	Octubre	Noviembre	Diciembre
1	Identificacion de peligros - evaluacion de Riesgos	28/02/2019											
2	Tala Controlada	28/02/2019											
3	Manual de Resolucion de Conflictos/ Sistema de quejas	16/03/2019											
4	Equipos de Protección Personal	28/03/2019											
5	Seguridad Industrial	28/03/2019											
6	Reglamento Interno de Seguridad	10/04/2019											
7	AIR	12/04/2019											
8	Fauna silvestre y su conservación	12/04/2019											
9	Manejo adecuado de combustible	12/04/2019											
10	Cadena de Custodia	10/05/2019											
11	Manipulacion adecuada de Alimentos	17/05/2019											
12	Organización Internacional de Trabajo	14/06/2019											
13	Acuerdos y convenios suscritos por el Perú	21/06/2019											
14	legislación forestal vigente	21/06/2019											
15	Reglamento Interno de Trabajo	05/07/2019											
16	Certificacion Forestal FSC 100%	12/07/2019											
17	Manejo de Residuos	12/07/2019											
18	Manual de Resolucion de Conflictos	19/07/2019											
19	Prevencion de Incendios	25/07/2019											
20	Manual de Operaciones de Transporte	01/08/2019											
21	Manejo de Residuos - Contaminacion por Plastico	01/08/2019											
22	Bosques de alto Valor de Conservacion	13/09/2019											

2.3.15 Community Employment Opportunities (G3.10)

The Company Guideline for hiring personnel states that local families are prioritized as a contingency measure to avoid social conflicts. This will include training in harvesting operations and organization of hired population. We recognize the importance of hiring family groups from surrounding areas for Brazil nut collecting, for instance, as this non-timber forest product is present in FORESTAL OTORONGO concession and its harvesting is allowed by the Intermediate Forestry Management Plan, approved by forest authority.

2.3.16 Relevant Laws and Regulations Related to Worker's Rights (G3.11)

TABLE 29: LEGAL FRAMEWORK ON LABOUR ISSUES

Norm	Effective Date	Relevant articles demonstrating compatibility with the layout/implementation of the Project

LEGISLATIVE DECREE 728 (TUO SUPREME DECREE 003-97-TR) PRODUCTIVITY AND COMPETITIVENESS LAW	March 28th, 1997	This law promotes the massive access to employment through special programs and stimulates productive private sector investment. Furthermore, it improves levels of appropriateness in the country so substances, as well as combating unemployment and underemployment. Finally, ensures job security and incomes of workers, while respecting the constitutional rules of job security.
SUPREME DECREE 001-96-TR PRODUCTIVITY AND COMPETITIVENESS REGULATION	January 26th ,1996	This regulation develops and specifies the objectives and tenets of Legislative Decree 728.
LAW 29245 THIRD-PARTY SERVICES PROVIDER LAW	June 26th, 2008	This law regulates private third-party services. Also it regulates the cases from outsourcing, the requirements, rights and obligations, and penalties for companies that distort the use of this method for corporate engagement.
SUPREME DECREE 006-2008-TR THIRD-PARTY SERVICES PROVIDER REGULATIONS	September 12th, 2008	This regulation develops and specifies the objectives and tenets of Law 29245.
TUO SUPREME DECREE 001-97-TR SENIORITY BENEFITS LAW	March 1st, 1997	This law regulates compensation for length of service that has the quality of social benefit provision of contingencies that causes the cessation of work and promotion of workers and their families.
SUPREME DECREE 004-97-TR SENIORITY BENEFITS REGULATION	April 15th, 1997	This regulation develops and specifies the objectives and tenets of Supreme Decree 001-97-TR
LEGISLATIVE DECREE 713 VACATION LAW	November 8th, 1991	This law regulates the consolidation of the benefits provided by the existing labor laws.
SUPREME DECREE 012-92-TR VACATION REGULATION	December 3rd, 1992	This regulation develops and specifies the objectives and tenets of Legislative Decree 713.
LAW 27735 HALF/END-OF-YEAR HOLIDAY BONUSES LAW	May 8th, 2002	This law establishes the right of workers subject to the labor of the private sector to receive two bonuses in the year, among others.
SUPREME DECREE 005-2002-TR HALF/END-OF-YEAR HOLIDAY BONUSES REGULATION	July 4th, 2002	This regulation develops and specifies the objectives and tenets of Law 27735.
LEGISLATIVE DECREE 892 PROFIT SHARING LAW	November 8th, 1996	This standard regulates the right of workers to participate in the profits of companies that develop income-generating activities.
SUPREME DECREE 009-98-TR PROFIT SHARING REGULATION	November 6th, 1998	This regulation develops and specifies the objectives and tenets of Supreme Decree 009-98-TR.
LEGISLATIVE DECREE 688 SOCIAL BENEFITS CONSOLIDATION LAW	5th, 1991	This law regulates social benefits for workers.
SUPREME DECREE 024-2001-TR SOCIAL BENEFITS CONSOLIDATION REGULATION	July 22nd, 2001	This regulation develops and specifies the objectives and tenets of Legislative Decree 688.
SUPREME DECREE 007-2002-TR LAW ON DAYS OF WORK, HOURS AND OVERTIME	July 4th, 2002	This law regulates days of work, hours and overtime in benefit of workers and proceedings for Peruvian labor authority and registries in order to organize quality and quantity of work hours. Finally, it sets the maximum days and hours of work, including for night work, and regulate overtime.
SUPREME DECREE 008-2002-TR REGULATION ON DAYS OF WORK HOURS AND OVERTIME	July 4th, 2002	This regulation develops and specifies the objectives and tenets of Supreme Decree 008-2002-TR.

LEGISLATIVE DECREE 25593 (TUO SUPREME DECREE 010-2003-TR) LAW ON COLLECTIVE LABOR RELATIONS	October 5th, 2003	This law regulates union's freedom, i.e., all those relations through which workers can bargain collectively for better working conditions or otherwise.
SUPREME DECREE 011-92-TR REGULATION ON COLLECTIVE LABOR RELATIONS	October 14th, 1992	This regulation develops and specifies the objectives and tenets of Law on Collective Labor Relations.
LAW 28806 LABOR INSPECTION LAW	July 22nd, 2006	This law aims to regulate the labor inspection system, its composition, organization structure, powers and duties in accordance with Convention 81 of the International Labor Organization.
SUPREME DECREE 019-2006-TR REGULATION OF LABOR INSPECTION SYSTEM	September 1st, 2007	This regulation develops and specifies the objectives and tenets of Law 28806.
LAW 26636 PROCEDURAL LABOR LAW	June 21st, 1996	This law regulates all the judicial procedures that workers and employers need to do in order to access justice.
SUPREME DECREE 039-91-TR INTERNAL REGULATION	December 30th, 1991	Every employer who employs more than 100 workers is required to have internal work regulations. The regulation must contain the main provisions of the labor regulations in force and will be approved by the administrative labor authority upon presentation. Workers who consider that the regulation violates legal or conventional provisions in force at the workplace may take legal action.

TABLE 30: LEGAL FRAMEWORK ON HEALTH AND SAFETY ISSUES

Norm	Effective Date	Relevant articles demonstrating compatibility with the layout/implementation of the Project
LAW 29783 HEALTH AND SAFETY LAW		This law aims to promote and organize safety and health in the workplace.
SUPREME DECREE 009-2005-TR HEALTH AND SAFETY REGULATION	September 28th, 2005	The regulation aims to promote a culture of risk prevention in the country. It counts with the participation of workers, employers and the State, who through social dialogue ensure the promotion, dissemination and enforcement of relevant legislation. This regulation on safety and health in the workplace establishes minimum safety and health standards, enforcement responsibilities, and rights.
MINISTERIAL DECREE 148-2007-TR REGULATION OF COMMITTEE FOR SUPERVISION OF SECURITY AND HEALTH AT WORK	May 25th, 2005	This regulation creates a Committee for supervision and enforcement of security and health at the workplace.
LAW 26842 GENERAL HEALTH LAW	July 20th, 1997	This law stipulates that those who lead or manage the extraction, production, transport and trade in goods and services have an obligation to take the necessary measures to ensure the protection of health and safety of workers and third parties on their premises.
LAW 26790 SOCIAL SECURITY MODERNIZATION LAW	May 17th, 1997	This law regulates health and social security; it is founded on constitutional principles that recognize the right to welfare and guarantee free access to services by public, private or mixed. It takes place in a

		framework of equity, solidarity, efficiency and ease of access to health services. This standard promotes efficiency for occupational health and integration of efforts of the entities that provide health services, whatever their nature is.
SUPREME DECREE 009-97-SA SOCIAL SECURITY MODERNIZATION REGULATION	September 8th, 1997	This regulation develops and specifies the objectives and tenets of Law 26790.
SUPREME DECREE 003-98-SA INSURANCE RISK WORK	April 14th, 1998	This standard regulates occupational accident coverage and occupational diseases to workers employed and workers who have the quality of regular member of the social health insurance and work in a workplace in which the employing entity carries out its regular activities.

2.3.17 Occupational Safety Assessment (G3.12)

The risks of the Project are limited to the forest harvesting carried out in each consolidated. In this regard, the internal regulations on occupational safety and health (annex 5) are in place.

This document serves to inform about the rules of conduct and procedures established to protect the physical and mental well-being of each worker, in accordance with the Safety Policy adopted by the Consolidated. It emphasizes the shared responsibility of both the employer and the workers in order to defend the life, health and physical integrity of the worker for his or her own interest and that of his or her family.

In 2017, the Occupational Safety and Health Committee (OSH) approved the internal regulations for Occupational Safety and Health. These regulations establish occupational safety and health standards for proper application and mandatory compliance by all company workers, third-party personnel, contractors, subcontractors, and visitors at any of the company's facilities.

This document is in accordance with Peruvian law as indicated in its legal framework and addresses relevant issues such as fire prevention and protection, protection of electrical machinery, equipment and engines, compressors and on security measures in the process of production, handling and transport of storage materials, security measures for the use of hoists, maintenance and repair, safety and health standards in operations, use of vehicles and the timely preparation of emergency responses.

On the latter, a contingency plan is made according to the nature of the risk, which is applied by the staff and conducted at the management level by the OSH committee and at the operational level by the brigade, such as: first aid, fire and evacuation. Staff selection and training for these brigades is carried out by the human resources (HR) team in collaboration with other organizational units that facilitate the participation of workers from their respective areas. For example, if a fire occurs, the brigade leader collects information on injuries and damages to open an investigation and propose corrective actions.

2.4 Management Capacity

2.4.1 Project Governance Structures (G4.1)

FORESTAL OTORONGO has designed a specific governance structure for the conducting of JAGUAR REDD+ PROJECT. It is integrated with the organizational structure of forest operations of the company.

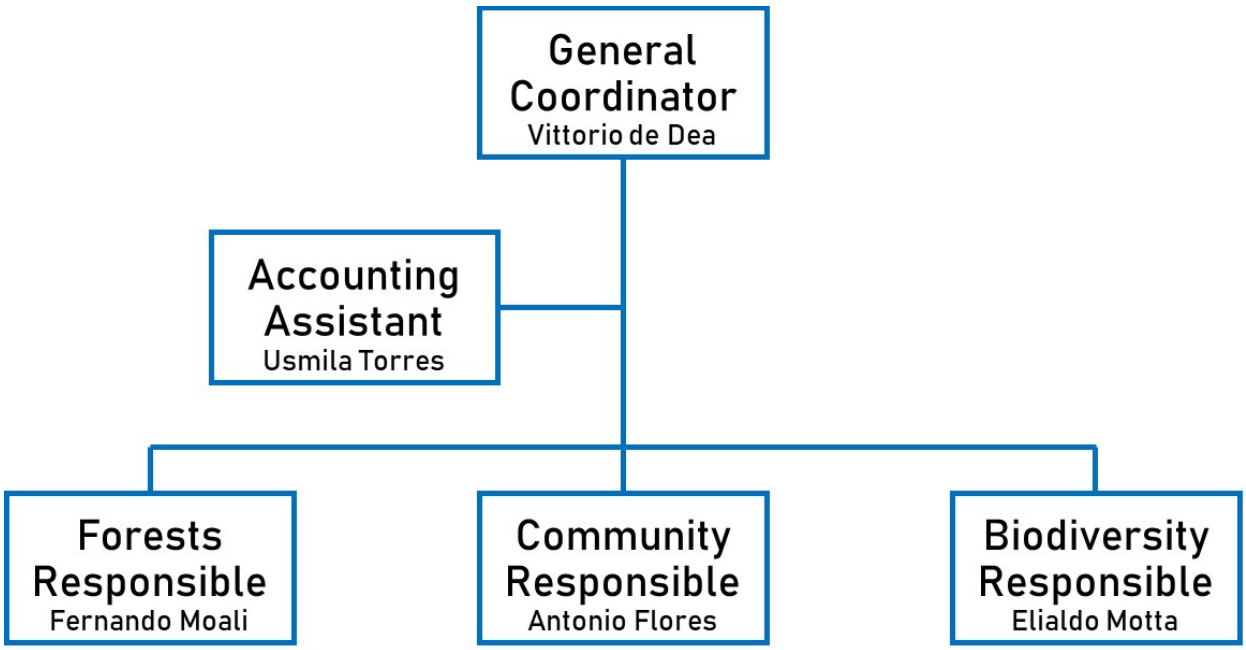
A general coordinator of the REDD+ project, leading a multidisciplinary team with three coordinators, each one related with each one of the components of the REDD+ project:

- A coordinator of forest aspects
- A coordinator of community relationships
- A coordinator of biodiversity monitoring

Each technical leader will organize its specific own team, according to needs and activities and will assume the responsibilities regarding to the monitoring of indicators related to his topic. The General Coordinator will also lead the MRV team of chart 6, in section 3.3.3.

Complementing the technical team, an administrative assistant will provide general support to the implementation of REDD+ activities. The organizational structure is reflected in the following summarized chart:

CHART 3: FORESTAL OTORONGO GOVERNANCE STRUCTURE FOR REDD+ PROJECT



2.4.2 Required Technical Skills (G4.2)

FORESTAL OTORONGO has a multidisciplinary technical team that includes profiles for required skills for the REDD+ project, including community engagement, biodiversity assessment, carbon measurement and monitoring.

In annex 6, the CVs of core personnel described in 2.4.1 are attached.

2.4.3 Management Team Experience (G4.2)

FORESTAL OTORONGO has a large experience in the timber sector as they have been producing and exporting timber products for decades. It implies the implementation of Corporate Social Relationship activities, especially with the surrounding population. As indicated in the FSC report, the high social standards are part of the permanent work of FORESTAL OTORONGO. In 2002, the Peruvian Government granted these concessions but the company group has nearly 50 years in the forest sector:

(https://issuu.com/bozovich/docs/reportaje_mundo_empresarial_-_40_a_os)

It includes specific rules about labor conditions, training for the local population in logging operations, ethical restrictions in the relationships of workers with the local population, among others.

Regarding biodiversity activities, FORESTAL OTORONGO also has many years of experience implementing a jaguar-monitoring plan as an index of biodiversity health and conservation.

2.4.4 Project Management Partnerships/Team Development (G4.2)

On the other side, FORESTAL OTORONGO is new in the carbon business and has no experience developing carbon projects, calculating GHG reductions and trading VCUs. For this reason, a partnership with GREENOXX, who has more than 16 years of experience in the carbon market and has developed previously this type of projects in REDD+ in Peru with FSC certified forest concessions, has been signed.

Another partnership established by FORESTAL OTORONGO is with the “Instituto de Educacion Superior Tecnologico Publico Iberia-Tahuamanu”. Through this partnership, students can work in the forest concession and can develop researches that are useful to increase the value of forests, by finding new species, new uses of known species, new technologies among others but also supporting the biodiversity monitoring plan.

2.4.5 Financial Health of Implementing Organization(s) (G4.3)

The cash flow included in annex 2 shows that the project is backed by the logging operations. As can be seen in Annex 2, the annual gross incomes from timber sales are US$ 9 million, while the expected incomes from carbon sales are US$ 3 million, which represents an additional 11% of current incomes, considering temporal horizon.

During the audit visit, auditors will have access to internal financial information that can demonstrate the financial health of FORESTAL OTORONGO, including annual memories, sales history and commercial contracts.

On the other side, GREENOXX also has the necessary financial health to provide commercial support during the whole cycle of the project while the INSTITUTE, as it is a public entity; it does not have any risk of financial failure.

2.4.6 Avoidance of Corruption and Other Unethical Behavior (G4.3)

In 2020, with the support of the United Nations Office against Drugs and Crimes (UNODC), FORESTAL OTORONGO elaborated and approved its guidelines for anti-corruption policy.

These guidelines started identifying potential areas of corruption risks (legal, commercial, reputational) and their potential impacts. From this diagnosis, it designs mitigation measures, including annual public reports about how the guidelines were addressed.

These guidelines are also included in annex 7.

2.4.7 Commercially Sensitive Information (Rules 3.5.13 – 3.5.14)

Commercial Information as prices and clients for timber and carbon components must be considered sensitive and confidential. This includes the cash flow of the whole operation.

Commercial agreement between project proponents is also considered sensitive information.

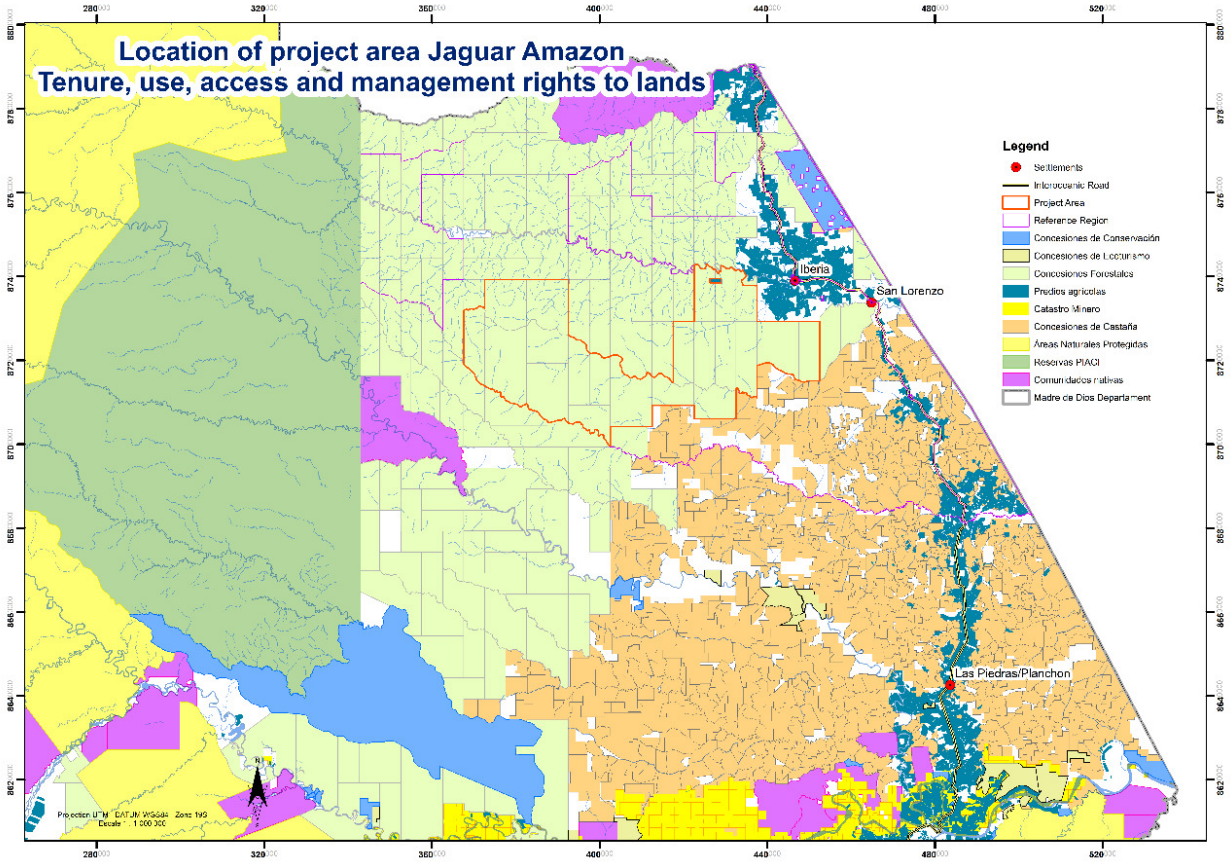
2.5 Legal Status and Property Rights

2.5.1 Statutory and Customary Property Rights (G5.1)

Madre de Dios is a region characterized by its pristine forests. A significant portion of its territory is legally protected with the creation of Natural Protected Areas while another significant portion of its territory has been granted as forest concessions. In the project zone, most of the areas are forest concessions (for timber purposes or for non-timber forest products such as Brazil nuts and shiringa). In the adjacent areas to the Interoceanic Highway, agrarian plots (titled and untitled) and settlements can be found.

In the northern part of the region, in the frontier with Brazil, there is an indigenous community. There are more indigenous communities in the southern part of Madre de Dios, some of them very threatened by illegal mining that operates in the south of Madre de Dios.

MAP 10: LAND TENURE IN PROJECT ZONE



2.5.2 Recognition of Property Rights (G5.1)

The Forestry and Wildlife Law No. 27308 and its regulations indicate that the management and use of forest resources in permanent production forests are carried out under public tender (40,000 ha) or public auction (10,000 ha) and that this award is for a period of 40 years, renewable. Likewise, it specifies that the Concessionaire is directly responsible for the area but not for the subsoil. The timber forest concessions that make up each concession (Otorongo and Chullachaqui) were awarded under the public tender modality and for their approval the General Forest Management Plans (PGMF) and the Annual Operating Plans (POA) were presented; as well as the payment for the right to use that is made to the State. It should be noted that each concession works as a large Concession, that is, it has only one PGMF and additionally can carry out the harvesting of other forest products, in this case Brazil nuts (Bertholletia excelsa) through a Complementary Plan (PC) presented to the competent authority. The contracts of each Consolidated with the State are detailed below and can be viewed in Annex 8:

- Consolidated Otorongo
  1. 17-TAH/C-J-042-02
  2. 17-TAH/C-J-043-02
  3. 17-TAH/C-J-044-02
  4. 17-TAH/C-J-017-02
  5. 17-TAH/C-J-009-03

6. 17-TAH/C-J-003-03

- Consolidated Chullachaqui
  1. 17-TAH/C-J-040-02
  2. 17-TAH/C-J-041-02
  3. 17-TAH/C-J-045-02
  4. 17-TAH/C-J-028-02

2.5.3 Free, Prior and Informed Consent (G5.2)

As already documented during FSC certification and other independent audits, there are no indigenous groups or traditional uses of forest resources that have been limited with the assignment of the forest concession. For this reason, no FPIC is needed.

2.5.4 Property Rights Protection (G5.3)

Concessions of timber products in forests of permanent production are contracts between the concession holder and the State. This contract defines UTM coordinates (Zone 19L WGS 84) each concession belonging to the consolidated Otorongo and Chullachaqui, thus protecting the right to use the surface within the area. The coordinates of the Consolidated are detailed below:

TABLE 31: COORDINATES OF PROJECT AREA

Consolidated Otorongo

Point	X	Y	Reference
V1	452,557	8,715,097	
V2	437,563	8,718,743	From V1 to V2: Cocama River or Sta Cruz
V3	437,561	8,711,044	
V4	432,534	8,712,939	From V3 to V4: Muymanu River
V5	432,558	8,706,061	
V6	422,557	8,706,061	
V7	422,557	8,709,251	
V8	412,548	8,709,253	
V9	412,547	8,714,619	
V10	417,557	8,714,619	From V9 to V10: Muymanu River
V11	417,557	8,729,249	
V12	422,557	8,729,249	
V13	422,557	8,742,595	
V14	428,591	8,741,203	From V13 to V14: Tahuamanu River

V15	429,002	8,741,203	
V16	429,010	8,742,538	
V17	435,037	8,740,215	From V16 to V17: Tahuamanu River
V18	434,216	8,737,823	From V17 to V18: Gorge N.N
V19	437,568	8,737,804	
V20	426,279	8,738,490	
V21	426,279	8,739,490	
V22	428,979	8,739,491	
V23	428,979	8,738,491	
V24	437,566	8,729,249	
V25	452,557	8,729,249	

Source: PGMF Otorongo (2018)

Consolidated Chullachaqui

Point	X	Y	Reference
V1	412548	8704241	
V2	402569	8704242	
V3	402569	8699534	From V3 to V4: Manuripe River
V4	382557	8709608	From V4 to V5: Manuripe River
V5	367557	8719141	
V6	367557	8731899	From V6 to V7: Muymanu River
V7	372557	8732250	
V8	372557	8739249	
V9	392557	8739249	
V10	392557	8725980	From V10 to V11: Muymanu River
V11	412547	8716142	

Source: PGMF Chullachaqui (2018)

2.5.5 Illegal Activity Identification (G5.4)

Many illegal activities could affect project objectives. They are described in the following chart:

TABLE 32: ILLEGAL ACTIVITIES IDENTIFIED AND MITIGATION MEASURES

ILLEGAL ACTIVITIES	MITIGATION MEASURES TO BE TAKEN
Illegal logging	An enhanced surveillance plan, including periodical patrolling and new control sites in rivers and access roads

Illegal hunting	An enhanced surveillance plan, including periodical patrolling
Illegal harvesting of non-timber forest products	Agreements with local families so they can provide an organized and sustainable harvesting of Brazil nuts
Invasion	An enhanced surveillance plan, including periodical patrolling
Forest fires / clearance of areas	Control sites, monitoring and patrolling actions

2.5.6 Ongoing Disputes (G5.5)

The concessions have been legally assigned to FORESTAL OTORONGO in forest areas that were being previously exploited by the same group based on previous forestry laws. The concession was granted in 2002 under the umbrella of the recently approved forestry law (in 2000), that changed completely how the forest was managed. With that law, the contract period extended to 40 years; the area was at least five thousands of hectares and the forest holder had the rights over all the resources existing in the granted territory. With the previous law, the right was only over a unique resource (in this case, the timber, while other people could have the right on other resources such as nuts, for example). The period was shorter and the area was smaller. The changes were key to ensure the sustainability of forest management. However, FORESTAL OTORONGO has a presence in the zone since many decades before the different changes in legal framework so no disputes are on the forest area.

2.5.7 National and Local Laws (G5.6)

The following is the current Peruvian legal framework applicable to the project. This legal framework comes from different levels of government and sectors, such as the central and regional government, the environmental and agricultural sectors, among others. The regulations included have been organized according to their subject matter (from general to specific) and scope (from national to regional).

TABLE 33: RELEVANT NATIONAL LEGAL FRAMEWORK

Laws	Term	Content
The Constitution	October 31st 1993	It has a chapter that establishes the State's policy with respect to the environment and natural resources. Thus, it provides in article 66 that natural resources, both renewable and non-renewable, are the heritage of the Nation, and that an organic law establishes the conditions for their use and their granting to individuals. The concession grants its holder a right in rem, subject to that legal rule. With respect to environmental policy, article 67 of the Constitution recognizes the role of promoting the use of natural resources, affirming the State's commitment to developing possible mechanisms for the conservation and sustainable use of its biological diversity. Likewise, article 69 emphasizes the role of the State in promoting the sustainable development of the Amazon.
Law No. 28611 "General Environment Law"	October 15th, 2005	In Article VI of this Law, it stipulates that environmental management has as priority objectives to prevent, watch and avoid environmental degradation, and that when it is not possible to eliminate the causes that generate it, the corresponding measures of mitigation, recovery, restoration or eventual compensation are adopted. Likewise, article XI mentions that the design and application of environmental public policies are governed by the

		principle of environmental governance, which leads to the harmonization of policies, institutions, regulations, procedures, tools and information in such a way that it is possible for the effective and integrated participation of public and private actors in decision making, conflict management and consensus building, based on clearly defined responsibilities, legal security and transparency. On the other hand, Article 150 of the Law stipulates that those measures or processes that, on the initiative of the owner of the activity, are implemented and executed with the purpose of reducing and/or preventing environmental pollution and the degradation of natural resources, constitute conducts that can be rewarded with incentives. Article 92 of the law states that the State promotes the sustainable use of forest and wildlife resources, as well as the conservation of natural forests, emphasizing the principles of management and zoning of the national forest area, the management of forest resources, legal security in the granting of rights and the fight against illegal logging and hunting. It also promotes and supports the sustainable management of wild fauna and flora, prioritizing the protection of endemic and endangered species and varieties, based on technical, scientific and economic information and traditional knowledge. Article 94 of this Act states that environmental services include the protection of water resources, the protection of biodiversity, the mitigation of greenhouse gas emissions and scenic beauty, among others. In addition, while they generate benefits that are used without retribution or compensation, it establishes the need for the State to establish mechanisms to value, compensate and maintain the provision of these environmental services, seeking to achieve the conservation of ecosystems, biological diversity and other natural resources. This article ends by mentioning that the National Environmental Authority (Ministry of the Environment) promotes the creation of financing, payment and supervision mechanisms for environmental services.
DL No. 1013 "Law for the Creation of the Ministry of the Environment"	May 15th, 2008	Through this standard, the Ministry of Environment is created, its scope of sectorial competence is established and its organic structure and its functions are regulated. The Ministry of Environment is the governing body of the executive branch of the environmental sector, which develops, directs, supervises and executes the National Environment Policy. The environmental sector includes the National Environmental Management System as a functional system, which integrates the National Environmental Impact Assessment System, the National Environmental Information System and the National System of Natural Areas Protected by the State. Among its functions is to develop and coordinate the national strategy against climate change and adaptation and mitigation measures, as well as supervise its implementation. It is also up to it to establish policies on environmental services, prepare the inventory and establish mechanisms to value, reward and maintain the provision of environmental services, as well as to promote financing, payment and supervision thereof. Finally, it is up to him to promote the creation of financing, payment and supervision mechanisms for environmental services.

DS No. 12-2009-MINAM "National Environment Policy	May 23rd, 2009	The elaboration of the National Environmental Policy is a mandate that comes mainly from the Political Constitution of Peru and the General Environmental Law, constituting a set of guidelines, objectives, strategies and instruments of a public nature that have the purpose of defining and orienting the actions of the entities of the National, Regional and Local Government, the private sector and the civil society, in environmental matters. The National Environmental Policy is divided into 5 objectives, 4 policy axes and specific objectives and guidelines for each policy. One objective of the National Environmental Policy relevant to the Project is to achieve the conservation and sustainable use of the country's natural heritage, with efficiency, equity and social welfare, prioritizing the integrated management of natural resources. The environmental services are identified within the National Policy of the Environment in diverse points, indicating the necessity to foment its economic valuation through economic and financial instruments, emphasizing the importance of implementing systems of conservation of forests and protection of such as far as the degradation and deforestation.
DS No. 006-2009-MINAM "Accurate denomination and proper functioning of the National Commission for Climate Change in accordance with Legislative Decree No. 1013"	March 29th, 2009	The general function of the National Commission on Climate Change is to monitor the various public and private sectors involved in the issue, through the implementation of the United Nations Framework Convention on Climate Change, as well as the design and promotion of the National Climate Change Strategy, whose content should guide and inform national, sectoral and regional development strategies, plans and projects.
RM 104-2009-MINAM "Approves procedure for the assessment and authorization of Greenhouse Gas (GHG) emissions and carbon sequestration projects"	May 24th, 2009	With the approval of this procedure, the Ministry of the Environment proposes to promote the conservation of the environment, guaranteeing the sustainable use of natural resources in the framework of projects developed under the Clean Development Mechanism provided for in the Kyoto Protocol, forestry projects, projects to reduce emissions from deforestation and degradation (REDD) and programmatic CDM. The General Directorate of Climate Change, Desertification and Water Resources of the Ministry of the Environment is responsible for responding to project conformity.
DS No. 014-2011-MINAM "National Plan of Environmental Action" PLANAA - PERU 2011-2021	July 9th, 2011	It is an instrument of long term national environmental planning, which is formulated from a situational environmental diagnosis and from the management of natural resources, as well as from the potentialities of the country for the use and sustainable use of such resources; in the same way, it is based on the legal and institutional framework of the National System of Environmental Management. The fulfillment of the priority goals will contribute with the conservation and the sustainable use of the natural resources, the improvement in the environmental quality; and therefore, to improve the quality of life of our population. Goals are presented in the areas of water, solid waste, air, forest and climate change, biological diversity, mining and energy, and environmental governance. The goal in the area of Forests and Climate Change is that by 2021 the rate of deforestation in 54 million hectares of primary forests under various categories of land management will be reduced to zero,

		contributing, together with other initiatives, to reducing 47.5% of GHG emissions in the country, generated by changes in land use; as well as reducing vulnerability to climate change.
DS No. 011-2015-MINAM "National Strategy on Climate Change" update of DS No 086-2003-PCM	September 23rd, 2015	It is based on adaptation to the adverse effects and takes advantage of the opportunities imposed by climate change, laying the foundations for low-carbon sustainable development. The main objectives are for the population, economic agents and the state to increase awareness and adaptive capacity for action against the adverse effects and opportunities of climate change and; for the population, economic agents and the state to conserve carbon reserves and contribute to the reduction of GHG emissions. The means necessary for implementation are based on institutional and governance, public awareness and capacity building, scientific knowledge and technology, and financing.
Law 26839 "Law on the Conservation and Sustainable Use of Biological Diversity"	July 17th, 1997	It regulates the general framework for the conservation of biological diversity and the sustainable use of its components. It includes provisions for planning, inventory and monitoring, conservation mechanisms, rural and indigenous communities, and scientific and technological research. The Act establishes that the principles and definitions of the Convention on Biological Diversity govern its implementation and contains a title on protected natural areas, which is consistent with the provisions of Act No. 26834.
Law 26821 "Organic Law for the Sustainable Use of Natural Resources"	June 27th, 1997	It regulates the general framework for the sustainable use of natural resources, as they are part of the Nation's heritage. This law establishes that the natural resources maintained at their source, whether they are renewable or nonrenewable, are part of the Nation's heritage. The fruits and products of the natural resources, obtained in the manner established in this Act, are the property of the holders of the rights granted over them. The rights over natural resources are granted to individuals through concessions, permits, and authorizations in accordance with the conditions established by the special rules for each resource. The special rules include the mechanisms for financial compensation to the State for the granting thereof, the maintenance of the right in force, the conditions for registration in the appropriate registry, and the possibility of assignment between individuals. This means that ownership, i.e. the ownership of the fruits and products obtained in accordance with this organic law, belongs to the holders of the rights granted over the areas where the natural resources providing them are located. The regulation for the grant of rights to private individuals for the use of natural resources, renewable and non-renewable, varies according to the nature of such resources.
DL No. 997 "Law on the Organization and Functions of the Ministry of Agriculture"	March 13th, 2008	The Ministry of Agriculture is the governing body of the agricultural sector and establishes the National Agricultural Policy, which is mandatory at all levels. Likewise, the Agrarian Sector includes the lands of agricultural use, of shepherding, the forest lands, the deserted lands with agrarian aptitude, the forest resources and their use; the flora and fauna; the hydric resources; the agrarian infrastructure; the activities of production, transformation and commercialization of crops and of breeding; and the services and activities linked to the agrarian activity such as the health, the

		investigation, the training, the extension and the transference of agrarian technology.
DL No. 1085 Establishes the Forest and Wildlife Resources Monitoring Agency"	June 28th, 2008	It created OSINFOR, which is responsible for supervising and overseeing the sustainable use and conservation of forest and wildlife resources, as well as the environmental services provided by the State through the various forms of use recognized in the Forestry and Wildlife Law and its regulations.
DS No. 030-2005-AG "Approve regulations for the Implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in Peru"	July 10th, 2005	This standard is intended to regulate CITES provisions and establish the conditions and requirements for trade, trafficking and possession of species included in them CITES Appendices I, II and III. Its provisions are intended to ensure compliance with all the precepts of the Convention, with the purpose and to protect the species of wild fauna and flora threatened due to their intense trade. It was modified and updated by Supreme Decree No. 001-2008-MINAM where the Ministry of Agriculture (through SERFOR) and the Ministry of Production are designated as CITES Administrative Authorities Peru, to the Ministry of Environment as CITES Peru Scientific Authority.
DS No. 009-2013-MINAGRI "National Forest and Wildlife Policy"	August 14th, 2013	The National Forest and Wildlife Policy is a state policy that involves all levels of government and public and private actors, being mandatory for regional governments. The purpose is to contribute to the sustainable development of the country, through an adequate management of the National Forest and Wildlife Heritage, which ensures its sustainable use, conservation, protection and increase, for the provision of ecosystem goods and services, forestry, other ecosystems of wild vegetation and wildlife, in harmony with the social, cultural, economic and environmental interest of the Nation through five political axes: institutionalism and governance; sustainability; competitiveness; social inclusion and intercultural and; knowledge, science and technology.
Law No. 29763 "Forestry and Wildlife Law" and its four Regulations	September 30th, 2015	Aims to promote the conservation, protection, increase and sustainable use of forest and wildlife heritage within the national territory, integrating its management with the maintenance and improvement of forest and other wild vegetation ecosystem services, in harmony with the social, economic and environmental interest of the Nation; as well as to promote forest development, improve its competitiveness, generate and increase forest and wildlife resources and their value to society. The purpose of this Law is to establish the legal framework to regulate, promote and supervise forestry and wildlife activities in order to achieve their purpose. Article 13 creates the Forestry and Wildlife Service (SERFOR) as a specialized technical public body, being the National Forestry and Wildlife Authority. Likewise, the SERFOR is the governing body of the National System of Forestry and Wildlife Management (SINAFOR) and is constituted as its technical-normative authority at the national level, in charge of dictating the rules and establishing the procedures related to its scope. It coordinates its technical operation and is responsible for its proper functioning. With regard to its functions, Article 14 highlights paragraph e) To monitor compliance with the obligations of the rights granted under its jurisdiction and to sanction violations arising

		from its failure to comply, respecting the powers of the Forestry and Wildlife Resources Oversight Agency (OSINFOR), the Environmental Assessment and Monitoring Agency (OEFA), regional and local governments and other public bodies; paragraph g) Exercise the function of Authority of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in Peru for the specimens of the species of wild flora and fauna that reproduce on land, including all kinds of amphibians and emerging aquatic flora. Article 18 of the Forestry and Wildlife Resources Oversight Agency (OSINFOR) is responsible for supervising and monitoring the sustainable use and conservation of forest and wildlife resources and the services provided by forest and other wild vegetation ecosystems, granted by the State through enabling titles regulated by this Act. The SERFOR and the regional and local governments, through their corresponding officials, compulsorily inform OSINFOR about the forest and wildlife management, the scope and status of the enabling titles granted, under administrative responsibility and without prejudice to civil and criminal liabilities. OSINFOR reaches in a timely manner all information that may be useful for the administration and control of forest and wildlife resources to the corresponding entity. In article 19, the regional government is the regional forestry and wildlife authority (ARFFS). Article 23. Forest and wildlife manager is the natural person with training and professional experience in the area that requires being managed and registered in the National Registry of Forest and Wildlife Regents, who formulates and subscribes to forest management or wildlife. He is responsible for directing the activities in application of the approved management plan, to guarantee the sustainability of the forest resource. It is jointly and severally responsible with the holder or holder of the enabling title of the veracity of the content of the management plan and its implementation, as well as the correct issuance of the forest transport guides. Article 29. Permanent production forests are established by ministerial resolution of the Ministry of the Environment, at the proposal of SERFOR, in category I and II forests, for the purpose of permanent production of wood and other forest products other than wood, as well as wildlife and the provision of ecosystem services. The State promotes the integrated management of these forests. To this end, the regional forestry and wildlife authority prepares, directly or through third parties, and approves the Master Management Plan containing, at a minimum, the identification of sites requiring special treatment to ensure the sustainability of harvesting, access routes, common roads and control points. Prior to its establishment, the State carries out the environmental impact assessment and consults the population that may be affected by its establishment.
DL No. 1085 “Law that creates the agency for the Supervision of Forest and	June 28th, 2008	OSINFOR is attached to the Presidency of the Council of Ministers and constitutes a budgetary statement. It is the entity in charge, at the national level, of supervising and monitoring the use and conservation of forest and wildlife resources, as well as environmental services from the forest, for their sustainability, in accordance with the national policy and strategy for integrated

Wildlife Resources"		management of natural resources and the policies on environmental services established by the Ministry of the Environment, within the scope of its competence. OSINFOR's competencies do not involve Natural Protected Areas, which are governed by their own Law.
DS No. 007-2013-MINAGRI "Regulation of Organization and Functions of the National Forest and Wildlife Service - SERFOR"	July 18th, 2013	It is the national forestry and wildlife authority, which exercises its powers and functions at the national, regional and local levels, is subject to the regulatory framework on the subject and acts in accordance with national policies, plans and objectives, constituting the governing body of the National System of Forestry and Wildlife Management, hereinafter SINAFOR, and its technical-normative authority, responsible for issuing regulations and establishing procedures related to the area of its competence.
DS No. 018-2015-MINAGRI "Regulation for Forest Management"	September 30th, 2015	The regulation aims to promote the conservation, protection, enhancement and sustainable use of the forest heritage, integrating its management with the maintenance and improvement of forest and other wild vegetation ecosystem services. This applies to the different natural or legal persons, of public or private law, linked to the management of forests and wildlife, to the sustainable use of forest resources, to the services of the ecosystems of wild vegetation and to the forest and other forestry and related activities, throughout the national territory.
Law No. 29263 "Law on Ecological Crimes"	October 2nd, 2008	Law that modifies the penal types of ecological and environmental crimes and typifies their aggravated figures, such as illegal trafficking of protected wild flora and fauna species, illegal trafficking of aquatic species of protected wild flora and fauna, illegal extraction of aquatic species, depredation of protected flora and fauna, illegal trafficking of genetic resources, crimes against forests and forest formations, among other related crimes.

TABLE 34: RELEVANT REGIONAL LEGAL FRAMEWORK

Laws	Term	Content
Law No. 27783 "Law on the Bases of Decentralization	July 17th, 2002	It regulates the structure and organization of the State in a democratic, decentralized and deconcentrated way, corresponding to the National Government, Regional Governments and Local Governments. It also defines the rules that regulate administrative, economic, productive, financial, tax and fiscal decentralization. Likewise, this law establishes the competencies of the three levels of government and determines the assets and resources of the regional and local governments; and regulates the relations of government in its different levels. Article 36 mentions shared competences, one of them being the promotion, management and regulation of economic and productive activities in their scope and level, corresponding to the different sectors, including the environmental sector.
Law No. 27867 "Organic Law of Regional Governments"	November 19th, 2002	Law that, in its sections 9 and 10, establishes constitutional, exclusive and shared competences to Regional Governments in environmental matters to promote and regulate activities or services in the environmental sector. They also establish exclusive competences to promote the sustainable use of forest resources and biodiversity; and shared competences for the sustainable management of natural

		resources, the improvement of environmental quality and the preservation and administration of regional reserves and natural protected areas. Article 53 of the same law establishes the functions of the regional governments in environmental and land-use planning matters. For the Regional Governments to be able to exercise the competences assigned by this law, a process of transference of those competences must be followed, which has the objective of accrediting that this level of government has the institutional capacities to assume them.
Regional Ordinance 007-2009-GRMDD/CR [17]	February 17th, 2009	Approves Opinion No. 003-2009-GOREMAD/CAMAYA establishing the Technical Commission on Climate Change in the Madre de Dios Region, which is responsible for proposing short-, medium- and long-term measures to raise awareness among the population and for establishing plans and programs to prevent a worsening of the conditions affecting the region's Amazon region, within the framework of the regional governments' responsibilities for the sustainable management of natural resources and the improvement of environmental quality and for the preservation and protection of regional reserves and protected natural areas Later modified by Regional Ordinance 005-2010-GRMDD/CR, where the name is changed to Technical Commission for Adaptation and Mitigation to Climate Change in the Madre de Dios region.
Regional Ordinance 032-2009-GRMDD/CR	December 4th, 2009	Approves Ecological and Economic Zoning of Madre de Dios at macro level at a scale of 1:250,000 as a basic instrument of territorial planning, for the implementation of development policies, programs, public and private investment projects that lead to the achievement of sustainable development of the department. Identifies the Ecological and Economic Units from which the most appropriate use is defined for each space. This means identifying areas with agriculture, livestock, forestry, fishing, mining, energy, protection, biodiversity conservation, ecotourism, urban-industrial, and so on. The Ecological and Economic Zoning of Madre de Dios establishes 20 productive zones, including 14 agricultural production zones and 4 forest production zones and other associations. All of them make use of agriculture, agroforestry, tourism, conservation, reforestation and research. These areas are graphically represented on the map of Ecological and Simplified Economic Zoning.
Regional Ordinance 001-2012-RMDD / CR (August 26th, 2010) modifies Regional Ordinance 011-2010-GRMDD / CR	July 7th, 2012	The Regional Environmental Commission (CAR) of the region of Madre de Dios is created, in attention to the Legislative Decree N°1013, Law of Creation, Organization and Functions of the Ministry of the Environment; being constituted, like the instance of environmental management, in charge to coordinate and to arrange the regional environmental policy, promoting the dialogue and the agreement between the sectors public, private and civil society, articulating its environmental policies with the Ministry of the Environment.

[17] This ordinance has not been published in the Diario Oficial El Peruano to date.

2.5.8 Approvals (G5.7)

In annex 9, the forest management plans approved by the Forest Regional Authority that establishes that FORESTAL OTORONGO has all the required approvals to exploit commercially to forest resources and forest ecosystem services in the Project area as described in legal analysis of 2.5.7.

2.5.9 Project Ownership (G5.8)

In annex 8, the concession contracts signed with the State that establishes that FORESTAL OTORONGO has clearly the legal rights to access to the forest resources and forest ecosystem services in the Project area as described in legal analysis of 2.5.7.

2.5.10 Management of Double Counting Risk (G5.9)

The project does not seek to commercialize carbon reduction units in other programs, systems or markets, except the voluntary market and through VERRA platforms. In the case that a national regulation requires some change in this decision, FORESTAL OTORONGO will communicate and retire the carbon reduction units appropriately.

2.5.11 Emissions Trading Programs and Other Binding Limits

The GHG emission reductions and removals generated by the project will not be used for compliance under such programs or mechanisms. Forest and Wildlife Law clearly states that the rights that are assigned to enabling titles forest holders (as timber forest concessions) include the right to benefit from environmental services, including the forest carbon storage.

2.5.12 Other Forms of Environmental Credit

The project has not sought or received another form of GHG-related environmental credit, including renewable energy certificates.

2.5.13 Participation under Other GHG Programs

The project is not registered, nor is seeking registration under any other GHG programs. It is not discarded that in the future, this will be evaluated as an alternative. The project expects to be registered in the Peruvian National GHG Registry.

2.5.14 Projects Rejected by Other GHG Programs

The project has never been rejected by any other GHG programs because it never applied to any GHG program as it is recently being developed.

2.5.15 Double Counting (G5.9)

Double sale and double counting is not allowed and will not be practiced. All the sales, including the type of market or standard used for the transaction, will be uploaded in the webpage of the project proponent (without publishing sensitivity information of the sale).

3 CLIMATE

3.1 Application of Methodology

3.1.1 Title and Reference of Methodology

VM006

Methodology for Carbon Accounting for Mosaic and Landscape-scale REDD Projects

Version 2.2 - 17 March 2017 - Sectoral Scope 14.

3.1.2 Applicability of Methodology

TABLE 35: METHODOLOGY CONDITIONS OF APPLICABILITY ASSESSMENT

VM0006		YES / NO
GENERAL	Each parcel in the discrete project area must meet all applicable conditions.	
ELIGIBLE LAND[1]	The land in the project area consists of either a contiguous area or multiple discrete parcels of the project area.	The Project area is a continuous forest polygon, composed by multiple small concessions consolidated.
	Comply with an internationally accepted definition of forest.	The PA is a forest concession granted by Peruvian State. It covers more than 183 thousands of hectares of forest land
	Qualify as a forest for a minimum of 10 years prior to the project start date.	It has been a concession since 2002
	The project area should be deforested or degraded in the absence of the REDD project activity.	Surrounding forest concessions and forest areas are already being deforested by the expansion of agrarian frontier.
	Deforestation and degradation should be of a mosaic nature.	The rural property in Peru is very small and the agrarian production is mainly caused by small-scale agriculture (less than 5 ha explains

		more than 90% of Amazon forest loss according to the ENBCC)
Causes of deforestation and forest degradation[2]	Conversion of forestland to farmland for subsistence agriculture.	The main driver of deforestation is agrarian production of neighboring communities, mainly Arca Pacahuara. They combine subsistence production with commercial production.
	Conversion of forest lands into settlements.	New settlements are likely to occur within the Project area even though they are not allowed. Recent history proves this type of land occupation practices.
	Conversion of forestland into infrastructure, including new roads.	Agrarian neighbors request and obtain municipality support to build new roads.
	The felling of timber for commercial sale (e.g. timber planks or posts for commercial sale).	
	The logging of wood for local businesses and household uses.	
	Collection of wood for commercial sale of firewood and charcoal.	
	Collection of wood for local domestic and industrial energy needs (e.g. cooking, home heating, tobacco curing, brick making).	
	Livestock in the forests.	
	Removal of vegetation from the understory (e.g. collection of thatch grass for roofing and bedding materials from livestock, shrubs and small trees for thatch fences).	
	Forest fires to the extent that they are not part of the dynamics of natural ecosystems (e.g. hunting-related forest fires, honey harvesting, and intentional dismantling of land with a high fuel load).	
ELIGIBLE PROJECT ACTIVITIES[3]	Strengthening the land tenure and forest governance situation.	The theory of change is based on a production-protection approach that states that the governance strengthening must be combined with productive development. As described below, the Project includes activities related to enhancement of surveillance and control
	Support the development and implementation of sustainable forest and land use management plans.	
	Demarcating forest, tenure and property boundaries; promote forest protection through patrolling of forests and forest boundaries; promote social inclusion and	100% of borders of the concessions have been marked with milestones and are periodically patrolled.

		administration in local communities; facilitating social fencing through capacity-building; and create mechanisms to alert law enforcement authorities to forest invasion. Fire prevention and firefighting activities, including building firewalls, reducing fuel loads, prescribed burning, education to minimize fires caused by intent, support for fire brigades, water tanks, fire guards and communication systems.	
		Reduce wood consumption and/or increase energy efficiency by introducing wood stoves or brick ovens and curing equipment.	Not considered
		Creation of alternative sources of fuelwood through agroforestry, management of forest plots and introduction/intensification of other renewable and non-fossil fuel based energy sources (such as solar energy)	Not considered
		Sustainable agricultural intensification on existing agricultural land. - Development of local enterprises based on sustainably harvested non-timber forest products (NTFPs), such as honey, medicinal plants, etc.	FORESTAL OTORONGO does not propose sustainable agricultural intensification within his activities. FORESTAL OTORONGO will extend its social work with neighboring communities by supporting sustainable productive projects related with agrarian crops and other innovative products with local families
OPTIONAL ACTIVITIES	ASSISTED NATURAL REGENERATION (ANR)[4]	They should take place on degraded land where no previous NRA activity has taken place.	No assisted natural regeneration is included between the activities
		Areas that were forest at the beginning of the project, but were deforested during the project's accreditation period, are eligible.	
		NRA activities consist of thinning, removal of invasive species, enrichment planting and coppicing.	
		If harvesting takes place or is planned in areas where NRA activities take place, this area should be considered as an area under harvest.	
		Area of NRA activities: deforested area/year - natural regeneration/year.	
		Specify the size and location of the NRA's area of activity.	
	EXPLOITATION[5]	The harvesting plan and harvesting activities should follow the guidelines of the Best Management Practices (BMP) of the country or jurisdiction, if such guidelines exist.	
		The harvest plan should describe procedures to protect soil, water, and residual trees in the harvest area and provide documentation of the presence/absence of any threatened or endangered species at the site, the	

		potential impacts on the species, and the mitigation measures to be employed.	
		The harvest plan must describe the biophysical sustainability of the harvesting practices.	
		At minimum, the biophysical sustainability must be demonstrated by ensuring that the net removal of biomass from harvesting is less than or equivalent to the net increment of the biomass in the forest.	
		Where possible, the project proponent should use criteria and indicators such as from International Tropical Timber Organization (ITTO) to assess the sustainability of harvesting practices.	
		In addition, it is recommended to obtain sustainability certification from third parties, such as the Forest Stewardship Council or the Sustainable Forestry Initiative.)	The whole area has been certified under FSC standard since 2011.

[1] Not applicable to organic soils or peatlands.
[2] and [3] You must submit one or more of the activities.
[2] None of the above factors should be of a planned nature.
[2] If deforestation is occurring for a specific factor as a result of planned forest conversion activities, then that factor should be excluded from the analysis.
[4] and [5] You are only eligible if all activities are completed.

At national level, there is not a Best Management Practice (BMP) handbook. The official tools for forest management are: 1) the Forest Management General Plan (PGMF), that provides a general landscape of the original state of the forest and the plan for future harvesting and; 2) the annual operational plan (POA) that includes the forest census, that registers the 100% of existing trees and details all the activities that will be done in the Forest Management Unit (UMF) during the implementation, monitoring and control, focused on the target to ensure the sustainability of the system.

These documents must be approved by the Regional Technical Authority for Flora and Wildlife (ARTFFS) for the granting of the requested area and to start forest harvesting.

The Consolidated (Otorongo and Chullachaqui), presented their General Management Plans in 2018 and cover the next 5 years (Executive Management Resolution No. 046-2016-SERFOR-DE).

It indicates that harvesting activities will be of entresaca to simulate the dynamics of the natural forest, and will use the Reduced Impact Logging (AIR) technique to minimize forest disruption. In addition, there are manuals for the evaluation of roads, clearings, troza yard, trawl roads; internal procedures and solid waste management; as well as the procedures for the implementation of forest censuses, the forestry plan, safety protocols and monitoring is carried out at each stage of the use which is detailed in the "Monitoring of the PGMF 2019".

For logging, the POA is presented which is the planning document of all activities planned for the Short Plot (PC) within the UMF. The POA for Forest Concessions for timber purposes shows the detail of the impacts by type of activities and their mitigation measures, as shown in the following table:

TABLE 36: EXPECTED IMPACTS AND MITIGATION MEASURES IN LOGGING OPERATIONS

Activities	Impact Description	Mitigation Measures
Camp building	Camp disruption Elimination of plant cover	The camp will be installed in a naturally flat area of land. We will try to locate a naturally cleared area
Forest inventory	Decrease in latizals and brinzales of species of interest	The company has trained staff who recognize species of commercial interest in their early stages of development,
Planning and building of road network and storage yard	Opening of clearings with interruption of plant cover. Sometimes roads could cross sections with steep slopes and vegetation clearing would cause landslides and landslides, erosion, compaction and increased surface runoff	Planning and building of the road network with appropriate technical specifications and strictly necessary dimensions. The species dispersion map will also be used for the planning and construction of the road network and infrastructure installation for harvesting activities, The construction of forest roads in places with steep slopes requiring cuts and fillings of the land will be avoided. Take advantage of the flat areas for the collection of wood avoiding the unnecessary opening of the forest, in the installation of collection patios.
Logging	Trees may fall on adjoining and/or residual vegetation or on forest roads	The company has trained personnel in the application of reduced impact logging techniques (controlled logging)
Carrying and storage of trunks	Forest areas will be cleared and sotobosque removed. There could be oil, grease and oil spills.	Only the necessary spaces for the collection yards will be opened. Proper construction of forest roads will be done Appropriate machinery shall be used under operating conditions.
Transportation	There will be erosion in the soil of the roads, as well as compaction and loss of organic matter, in turn, an increase in surface runoff	The transport of wood will take place in dry season, avoiding the transit of vehicles when it rains, vehicle overload will also be controlled.
Silvicultural interventions	It could decrease the natural regeneration of some species	Use a default harvest intensity based on the future possibilities of the forest and the company's requirements. Use of the trees after the spread of seeds to give the species the opportunity to reproduce. Also, respect the quota of selected seedling trees.
All the stages	Increased hunting. Soil contamination through increased organic and inorganic waste.	The hunting of wild animals is forbidden within the concession; camps are periodically supplied with meat from domestic animals. There are currently two checkpoints and surveillance stations in critical areas of the concession, where rigid control is exercised to prevent poaching. For waste, these will be selected as organic and inorganic. Biodegradables will be managed in landfill-type wells with special treatment, within the concession. Inorganics will be come out of the concession.

Source: POA 2018 Consolidado Otorongo. Environmental Impact Assessment

In the document "Update of the study of forests of high conservation value in the consolidated Otorongo"- 2017. HCV 1.2 Endangered or Endangered Species (IUCN/CITES) lists the species recorded in the field assessments in the following table and also the photographic record.

TABLE 37: ENDANGERED FAUNA SPECIES IN PROJECT AREA

Nombre Común	Nombre científico	Legislación Nacional	CITES	IUCN
Mamíferos				
Añuje	*Dasyprocta sp*			
Ardilla colorada	*Sciurus pymhinus*			
Maquisapa	*Ateles paniscus*	Vulnerable	II	
Mono blanco	*Cebus albifrons*		II	DD
Mono huaslta	*Saimiri sciureus*		II	
Coto mono	*Alouatta seniculus*	Casi amenazado	III	
Mono martin				
Mono negro	*Cebus apella*		II	NT
Mono Pichico	*Sanguinus fuscicollis*		II	
Mono tocon	*Callicebus moloch*	Vulnerable	II	
Oso bandera	*Myrmecophaga trydactila*	Vulnerable	II	VU
Puma	*Puma concolor*	Casi amenazado	I	VU
Otorongo	*Panthera onca*	Casi amenazado	I	VU
Sachavaca	*Tapirus terrestris*	Vulnerable	II	NT
Sajino	*Tayassu tajacu*		II	
Huangana	*Tayassu pecari*		II	
Venado cenizo	*Mazama gouazoubira*			
Venado colorado	*Mazama americana*			DD
Aves				
Aguila arpia	*Harpia harpyja*	Vulnerable	I	VU
Tatatau	*Daptrius americanus*			
Paujil	*Mitu tuberosum*	Casi amenazado	I	
Pava campanilla	*Pipile cumanensis*	Casi amenazado		
Trompetero	*Psophia leucoptera*			
Aurora	*Ara severa*	Vulnerable		
Guacamayo	*Ara macao*	Vulnerable	I	
Panguana	*Crypturellus undulatus*		I	
Perdiz	*Tinamus sp.*			
Paucar				
Reptiles				
Motelo	*Geochelone denticulata*	Peligro	II	VU
Lagarto negro	*Melanosuchus niger*	Vulnerable	II	EN

Source: HCV Report 2017 Consolidado Otorongo

CHART 4: PICTURES OF FAUNA PRESENCE IN PROJECT AREA



Sachavaca (*Tapirus terrestris*)



Venado colorado (*Mazama americana*)

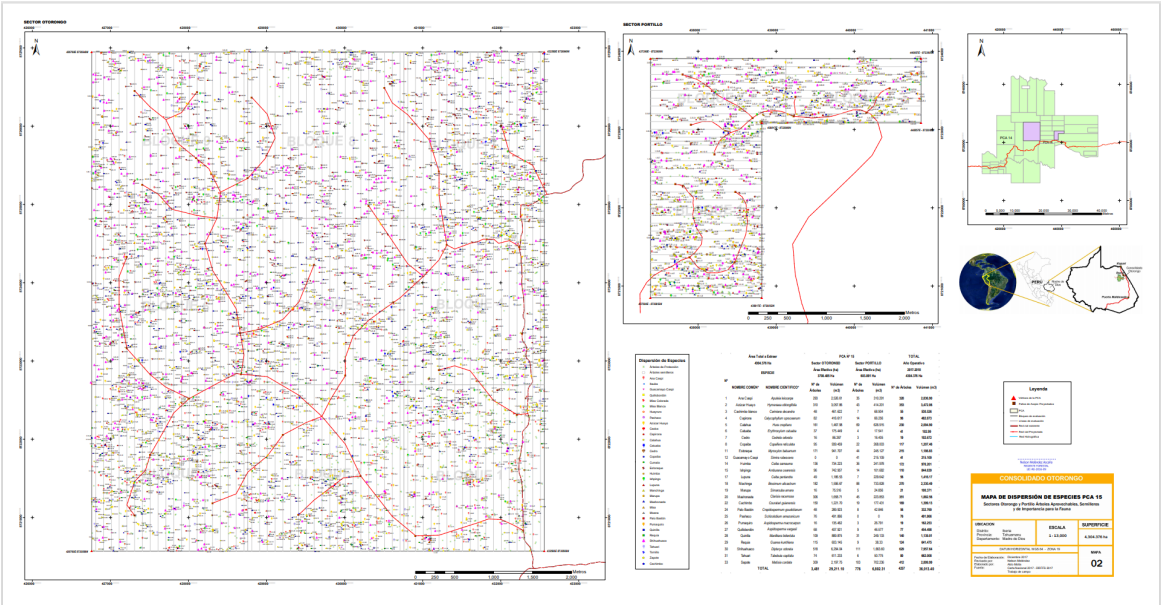
	
Tigrillo (*Felis pardalis*)	Pichico emperador (*Saguinus imperator)*

On the other hand, for the planning of operations within each PC, it is pre-checked with satellite images, the hydrographic network and the relief of the area. In addition, it has the procedure for the implementation of forest censuses that aims to:

- The registration of harvestable trees (commercial volume), trees of future harvest, seedling trees, trees of species of importance for the fauna and trees for non-timber forest products, determining their location (UTM coordinates) and dimensions.
- Obtain dasometric information of individuals of commercial species from 30 cm; CITES species, cedar and mahogany from 10 cm.
- Pruning of bejucos and vines of all harvestable individuals and seedlings.
- Record location information (UTM coordinates) and extension of special areas: collpas, drinkers, feeders, among others important for wildlife.
- Marking of trees evaluated using plates with correlative code.
- Marking of seedling trees (20% usable) using red paint.
- Registration on wildlife sighting during the census.

As a result, the scatter map of individuals by species is obtained; water network in detail; database for the calculation of volumes by species, data for road network planning and collection patios; important areas for wildlife.

MAP 11: SCATTER MAP FOR PCA 15



SOURCE: POA 2018 – Consolidado Otorongo

Likewise, regarding logging operations, the necessary guidelines for each type of operations are detailed, including the technical and planning characteristics to be carried out by the personnel according to their function and the appropriate equipment and machinery in each part of the operation.

The aim of permanent forest sampling plots (PPM) is to assess the growth and yield of species of commercial interest; and obtain data on the responsiveness of the forest to the harvest intensity applied by the company over time. Therefore, at this time, a determination could not be made as to whether biomass removal due to harvesting is less than the net increase in biomass.

The species of commercial interest are:

TABLE 38: COMMERCIAL TIMBER SPECIES

N°	Nombre Común	Nombre Científico
1	Ana caspí	*Apuleia Leicocarpa*
2	Azucar huayo	*Hymenaea sp*
3	Caoba	*Swietenia macrophylla*
4	Cedro	*Cedrela odorata*
5	Estoraque	*Myroxylum balsamun*
6	Ishpingo	*Amburana cearensis*
7	Mashonaste	*Clarisia racemosa*
8	Misa	*Couratari guianensis*
8	Pumaquiro	*Aspidosperma macrocarpum*
10	Quinilla	*Manilkara bidentata*
11	Shihuahuaco	*Dipteryx sp*
12	Tahuari	*Tabebuia sp*

SOURCE: PPM Establishment Report-2017

Likewise, regarding the ecology of the main species, it is detailed that these species of interest have not only been selected for their market demand but also under ecological parameters. Table 39 details the ecological livelihood for the use of these species and the more detailed analysis in the document.

It should be noted that for the cases of "mahogany" (*Swietenia macrophylla*) and "cedar" (*Cedrela odorata*), the considerations are different, since both are under a threatened category in the CITES and IUCN lists, being defined as critical species and of high interest for conservation, which is why, its use, should be supported by ecological parameters that allow to respond in a positive way, to the impacts that will be subjected and make their continuity feasible. On the species "Ishpingo" (*Amburana cearensis*), although it is only considered threatened on the IUCN list, the decision for it harvesting should be evaluated according to the same analysis performed for the previous case.

With the data obtained in the PPM, the analysis of harvest projection for each species of commercial interest will be done. To do that, it is required: minimum cutting diameter, average annual diametric increase, death rate, percentage of discarded, percentage of seedlings (20% fixed by law), logging intensity, future harvest trees, cutting cycle, remnant rate, number of trees per diametric class, reconstitution rate (degree of forest recovery). This data is inserted into the Harvest Projection Simulator, the cutting cycle in the consolidated is 20 years to return to the initial UMF (year 1) and the use of the

species will depend on the existing natural regeneration and its recoverability. For example, "shihuahuaco" has greater regeneration problems, this can be seen by observing the diametric distribution curve it develops. It requires a longer period of recovery, which is why after the first cutting cycle of 20 years, recovery cycles of 73 years must be implemented, that is, it will stop taking advantage of this species, leaving a longer time for its recovery.

TABLE 39: THREAT STATUS OF TIMBER SPECIES

SUSTENTO ECOLÓGICO DE APROVECHAMIENTO DE LA ESPECIE							
Aprovechables		Status de Amenaza		Gremio Ecológico	Distribución Diamétrica	Densidad Poblacional	Situación
Especie	Nombre Cientifico	CITES	IUCN			(ind/Has)	
Ana Caspi	*Apuleia leicocarpa*	-	-	Intolerante a la sombra	Erratica (J normal)	0.367	Potencial
Azucar Huayo	*Hymenaea spp*	-	-	Tolerante a la sombra	Disetanea Irregular	0.788	Aprovechable
Caoba	*Swietenia macrophilla*	Cites II	Vulnerable	Intolerante a la sombra	Disetanea Irregular	0.080	No Aprovechable
Catahua	*Hura crepitans*	-	-	Intolerante a la sombra	Erratica (J normal)	0.471	Potencial
Cedro	*Cedrela odorata*	Cites III	Vulnerable	Intolerante a la sombra	Disetanea Irregular	0.559	Aprovechable
Copaiba	*Copaifera reticulata*	-	-	Tolerante a la sombra	Disetanea Irregular	0.116	Potencial
Estoraque	*Myroxylum balsamun*	-	-	Tolerante a la sombra	Completa (J invertida)	0.898	Aprovechable
Ishpingo	*Amburana cearensis*	-	En peligro	Intolerante a la sombra	Disetanea Irregular	0.405	Aprovechable
Lupuna	*Chorisia integrifolia*	-	-	Intolerante a la sombra	Completa (j invertida)	2.865	Potencial
Manchinga	*Brosimum alicastrum*	-	-	Tolerante a la sombra	Erratica (J normal)	0.788	Potencial
Palo Baston	*Machaerium sp*	-	-	Generalista	Completa (J invertida)	0.632	Potencial
Pumaquiro	*Aspidosperma macrocarpum*	-	-	Intolerante a la sombra	Disetanea Irregular	0.206	Aprovechable
Quillobordon	*Aspidosperma subincanum*	-	-	Indeterminado	Completa (J invertida)	0.773	Potencial
Quinilla	*Manilkara bidentata*	-	-	Tolerante a la sombra	Completa (J invertida)	1.524	Potencial
Requia	*Guarea trichiloides*	-	-	Tolerante a la sombra	Completa (J invertida)	0.795	Potencial
Shihuahuaco	*Dipterex spp*	-	-	Intolerante a la sombra	Erratica (J normal)	0.581	Aprovechable
Tahuari	*Tabebuia spp*	-	-	Intolerante a la sombra	Disetanea Irregular	1.030	Aprovechable

SOURCE: PPM Establishment Report-2017

PPM has been installed in 2017 and monitoring in 2018. This is not sufficient to be able to make a determination as to whether biomass removal by use is less than the net increase in biomass. However, the exercise was carried out with primary data on usable volume (POA 2018) and bibliographic references on increases in aerial biomass in tropical forests proposed by Chave *et al* (2008).

Forest area of the entire consolidated(ha): 182,179.2

Average Net Biomass Increase (t/ha*year): 0.38 [18]

- Average net biomass increase for the entire consolidated (forested areas):

182,179.2 * 0.38: 69,228,096 t

PCA15 harvestable volume[19] (m^3): 36,013.40

Density (g/cm3) of each harvestable species (various sources)[20]

[18] This average corresponds at Yasuni because is in the same region of the project
19 It should be noted that the volume to be used is not the one that is actually removed, 20% of seedling trees and others of interest to CITES fauna and species such as Cedar and Mahogany are left and not logged.
20 Average density for the region is 0.64 (FRA2010)

Standing tree-to-trunk performance year 2015: internal data presented in the "PGMF Monitoring" 2018 document.

- Removal of biomass by forest use

The following table lists:

1. Total volume (m3) by species

2. Dry density (t/m3) per species to determine biomass (t) by species: density * volume. This data is just the trunk

3. To project it to the whole tree, we used the yield for each species as detailed in the table and for those that do not have a specific value, we used the average of that year of 82.86% to determine biomass (t) by standing tree species: (dry biomass trunk (t) *100)/yield

4. the sum of the total biomass (standing tree) of the use amounts to: 26,601.62 t

The difference between the increase in net biomass and the removal of biomass by forest use is: 69,228,096 t - 26,601.62 t s 42,626.47 t (Positive)

TABLE 40: DETERMINATION OF DRY BIOMASS FROM THE HARVESTABLE VOLUME (m3) of PCA 15-2018

Área Total a Extraer			PCA Nº 15				TOTAL					
4304.376 Ha			Sector OTORONGO		Sector PORTILLO		Año Operativo					
Nº	ESPECIE		Área Efectiva (ha)		Área Efectiva (ha)		2017-2018					
			3700.485 Ha		603.891 Ha		4304.376 Ha					
	NOMBRE COMÚN*	NOMBRE CIENTIFICO*	Nº de Árboles	Volúmen (m3)	Nº de Árboles	Volúmen (m3)	Nº de Árboles	Volúmen (m3)	densidad (t/m3)	biomasa seca tronco (t)	rendimiento (arbol en pie a tronco 2015)	biomasa seca (t)
1	Ana Caspi	*Apuleia leiocarpa*	293	2,526.612	35	310.291	**328**	**2,836.90**	0.7	1985.8321	84.52	2349.54
2	Azúcar Huayo	*Hymenaea oblongifolia*	310	3,057.856	43	414.201	**353**	**3,472.06**	0.62	2152.67534	88.72	2426.37
3	Cachimbo blanco	*Cariniana decandra*	48	461.622	7	68.904	**55**	**530.53**	0.64	339.53664	82.86	409.77
4	Capirona	*Calycophyllum spruceanum*	82	416.617	14	66.256	**96**	**482.87**	0.75	362.15475	82.86	437.07
5	Catahua	*Hura crepitans*	161	1,467.984	69	626.915	**230**	**2,094.90**	0.36	754.16364	82.86	910.17
6	Catuaba	*Erythroxylum catuaba*	37	175.449	4	17.541	**41**	**192.99**	0.64	123.5136	82.86	149.06
7	Cedro	*Cedrela odorata*	16	86.267	3	16.405	**19**	**102.67**	0.42	43.12224	83.94	51.37
8	Copaiba	*Copaifera reticulata*	95	939.459	22	268.003	**117**	**1,207.46**	0.63	760.70106	82.86	918.06
11	Estoraque	*Myroxylon balsamum*	171	941.707	44	245.127	**215**	**1,186.83**	0.78	925.73052	116.88	792.04
12	Guacamayo Caspi	*Simira rubescens*	0	0.000	41	215.109	**41**	**215.11**	0.64	137.66976	82.86	166.15
14	Huimba	*Ceiba samauma*	136	734.223	36	241.978	**172**	**976.20**	0.57	556.43457	82.86	671.54
15	Ishpingo	*Amburana cearensis*	96	742.957	14	101.682	**110**	**844.64**	0.5	422.3195	82.28	513.27
17	Lupuna	*Ceiba pentandra*	49	1,186.528	7	229.642	**56**	**1,416.17**	0.28	396.5276	82.86	478.55
18	Machinga	*Brosimum alicastrum*	182	1,596.667	88	733.828	**270**	**2,330.49**	0.65	1514.8211	82.86	1828.17
19	Marupa	*Simarouba amara*	16	75.516	5	24.856	**21**	**100.37**	0.36	36.13356	82.86	43.61
20	Mashonaste	*Clarisia racemosa*	306	1,658.710	45	223.853	**351**	**1,882.56**	0.61	1148.36404	82.86	1385.91
22	Cachimbo	*Couratari guianensis*	150	1,221.703	19	177.431	**169**	**1,399.13**	0.52	727.54968	82.86	878.05
24	Palo Bastón	*Crepidospermum goudotianum*	48	289.923	8	42.846	**56**	**332.77**	0.64	212.97216	82.86	257.03
25	Pashaco	*Schizolobium amazonicum*	76	491.866	0	0.000	**76**	**491.87**	0.64	314.79424	82.86	379.91
26	Pumaquiro	*Aspidosperma macrocarpon*	16	135.462	3	26.791	**19**	**162.25**	0.67	108.70951	65.11	166.96
27	Quillobordón	*Aspidosperma vargasii*	68	407.921	9	46.577	**77**	**454.50**	0.64	290.87872	82.86	351.05
28	Quinilla	*Manilkara bidentata*	109	889.875	31	249.133	**140**	**1,139.01**	0.87	990.93696	82.86	1195.92
29	Requia	*Guarea kunthiana*	115	603.145	9	38.330	**124**	**641.48**	0.6	384.885	82.86	464.50
30	Shihuahuaco	*Dipteryx odorata*	518	6,294.044	111	1,663.597	**629**	**7,957.64**	0.93	7400.60613	111.58	6632.56
31	Tahuari	*Tabebuia capitata*	74	611.233	6	50.775	**80**	**662.01**	0.64	423.68512	83.88	505.11
33	Sapote	*Matisia cordata*	309	2,197.749	103	702.236	**412**	**2,899.99**	0.64	1855.9904	82.86	2239.91
TOTAL			**3,481**	**29,211.095**	**776**	**6,802.306**	**4,257**	**36,013.40**		24370.7079		26601.62

Own elaboration

All this information has been the basis for the granting of the Forest Management Certificate under the Forest Stewardship Council -FSC Principles and Criteria for both the Consolidated Otorongo and the consolidated Chullachaqui compromising compliance with current national standards regarding: sustainable forest management (flora and fauna); environmental impacts; social welfare for workers (occupational safety, contracts, etc.) and good relationship with surrounding communities.

The Forest management system used in the Consolidated Is the Entresaca Polycyclic, the same that, as the basis, applies "logging" or exploitation, as the first treatment Forestry, creating the clearings necessary for the growth of Natural Regeneration, increasing the proportion of commercial species, without eliminating undesirable species and promoting the dispersal of seeds from trees specially selected for such end. Trees that compete directly with trees of future harvesting are eliminated. In addition, inventory data, parameters such as cutting cycle, minimum cutting diameter, cutting intensity and permissible annual cutting volume. Finally, AIR techniques are applied to minimize forest damage.

The project proponent employs a polycyclic forest management system of entresaca. Polycyclic because it has a logging cycle of 20 years (time lapse required for the recovery and next logging cycle); entresaca because only desirable species competing with future harvest species were cut and harvesting would work as the first forest treatment, promoting natural regeneration by the clearings that were formed. Logging planning has been divided into five-year blocks and each consolidated has 4 blocks as can be seen in the following map and also is characterized by forest types: protection; strong low hill with paca; soft low hill; low forest terrace with paca and strong dissected terrace forest with paca (yellow). As well as the determination of areas (ha).

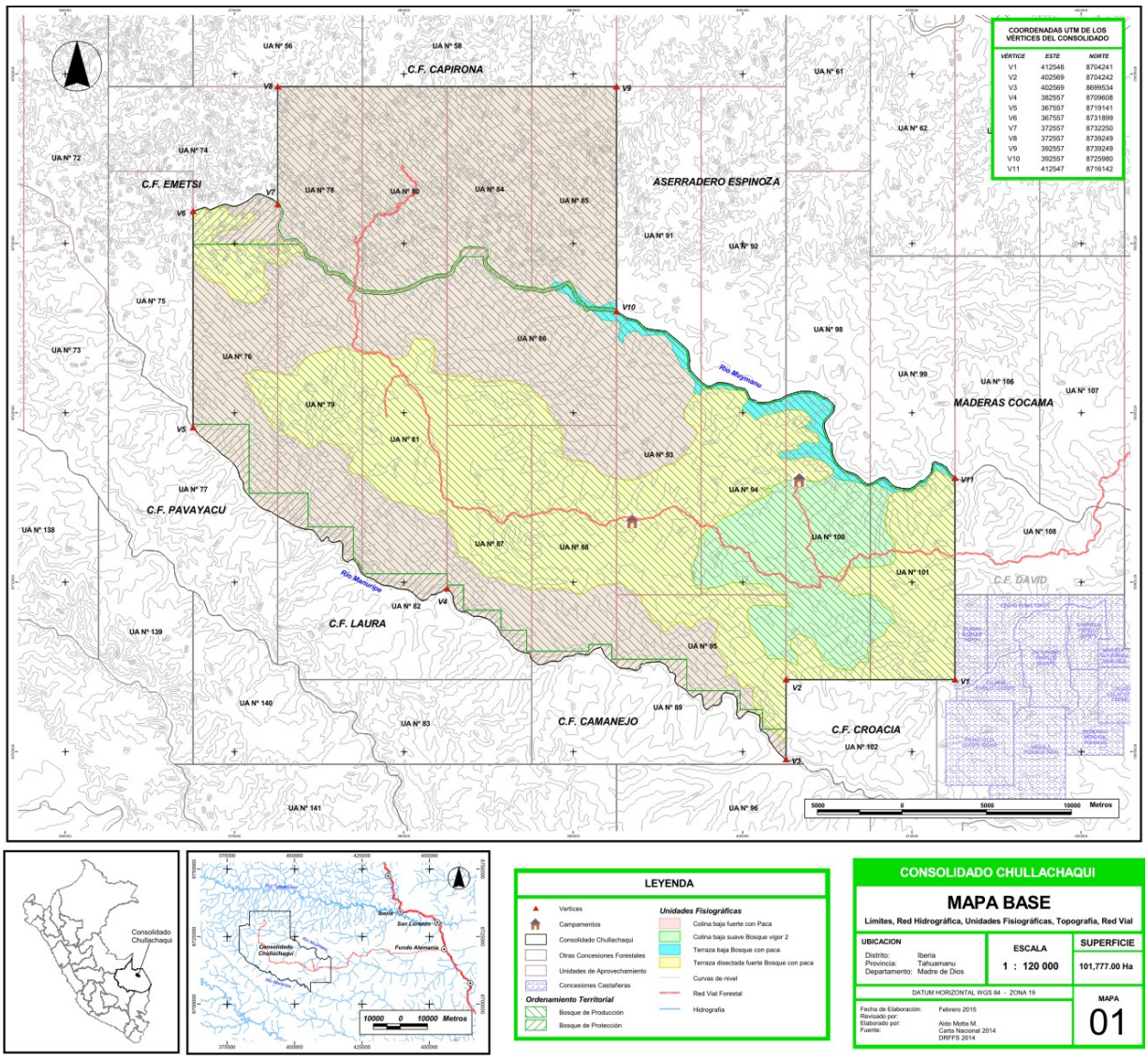
Plan General de Manejo Forestal - PGMF

This is the base document to begin the scheduling of the harvests in the study area. The exploratory inventory is previously carried out for both the Consolidated Chullachaqui and the Consolidated Otorongo, which are detailed below:

The exploratory forest inventory.

It works on a base map where the physiographic units, the contour lines (topography), the hydrographic network, the forest road network, the areas of production forest and the protection forests (in the limits of the consolidated and on rivers, streams, watercourses leaving a legal margin of 50 m) of the utilization units within the Consolidated. The maps for both Consolidated are presented.

Map 12: CHULLACHAQUI CONSOLIDATED BASE MAP



Source: PGMF Chullachaqui, 2018

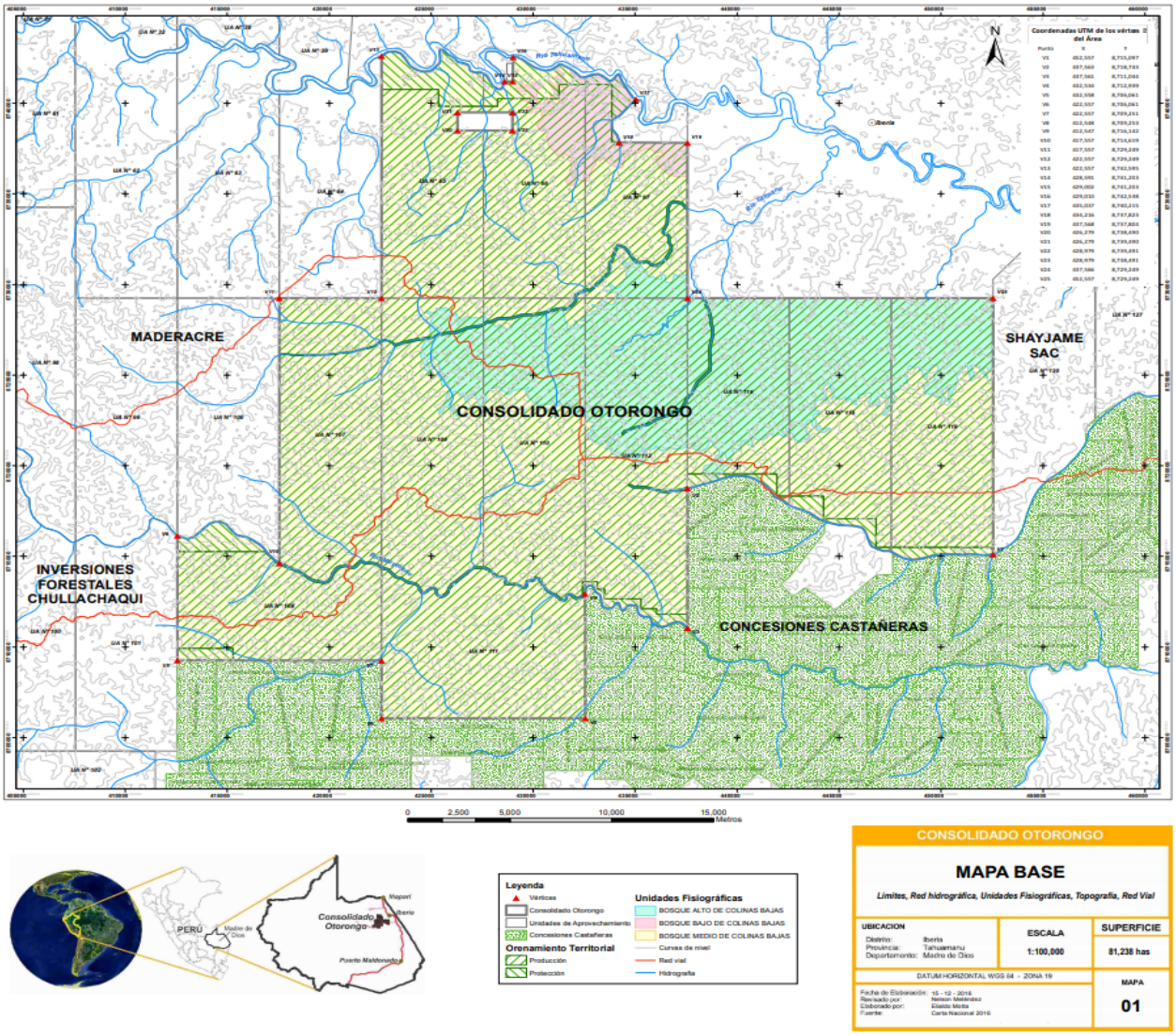
Thus, the classification by type of forest for the entire concession was obtained, as shown in Table 41.

Table 41. Planning Consolidado Chullachaqui

Categoría de ordenamiento	Área (ha)	%
Con Cobertura boscosa	101,777	100
Bosque de producción forestal	96,688.149	95
- Bosque de protección (fajas marginales, laderas empinadas, cabeceras de cuenca, entre otros)	5,088.851	5
Bosque intervenido (degradado o bosque secundario)	0	0%
Otras formaciones boscosas (aguajales, varillales, pacales, otros)		0%
Sin cobertura boscosa	101,777	100%

Source: PGMF Chullachaqui, 2018. Page 9.

Map 13: OTORONGO CONSOLIDATED BASE MAP



Source: PGMF Otorongo, 2018

Thus, the classification by type of forest for the entire Consolidated was obtained, as shown in Table 42.

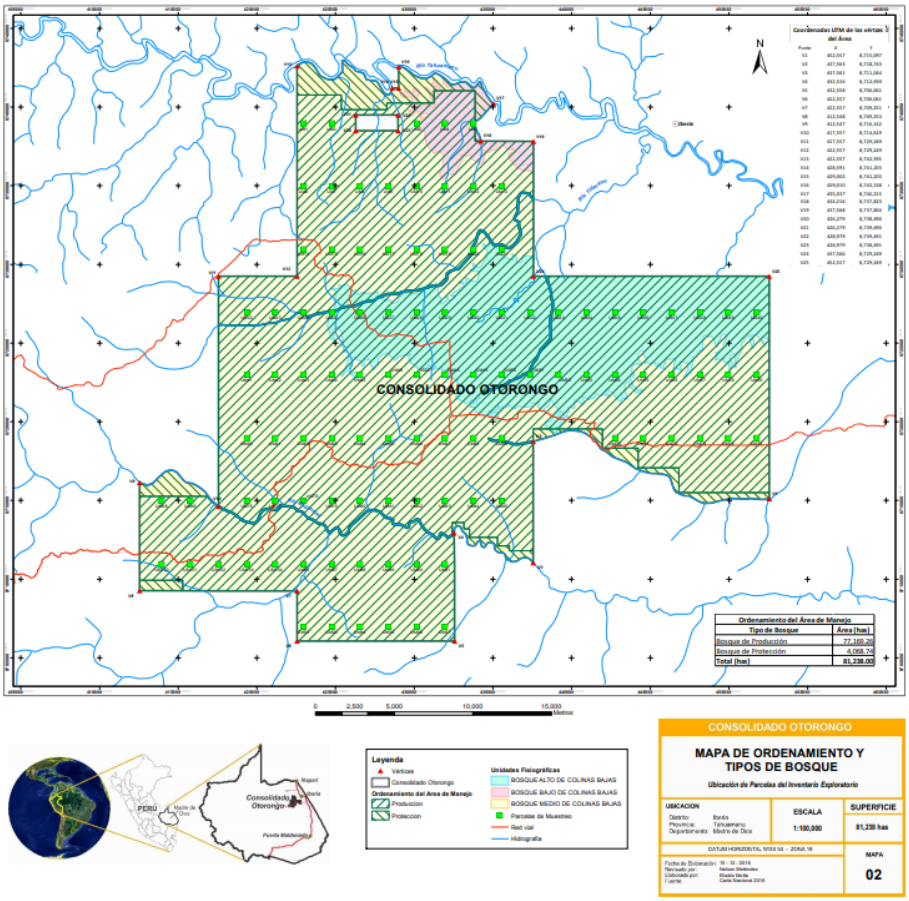
Once with the base map, the exploratory inventory is designed in the Sample Units (MU), for this the area of production forest is gridded and systematically a sample unit is placed equidistant, resulting in Map 13 and Map 14 for the Consolidated Chullacchaqui (171 MU) and Consolidado Otorongo (97 MU) respectively.

Table 42. Planning Consolidado Otorongo

Categoría de ordenamiento	Área (ha)	%
Con Cobertura boscosa	81,238	100%
Bosque de producción forestal	77,169	95%
- Bosque de protección (fajas marginales, laderas empinadas, cabeceras de cuenca, entre otros)	4,069	5%
Bosque intervenido (degradado o bosque secundario)	0	0%
Otras formaciones boscosas (aguajales, varillales, pacales, otros)	0	0%
Sin cobertura boscosa	0	0%
Áreas de protección (pantanos, lagunas (cochas), laderas empinadas, etc)	0	0%
Áreas deforestadas (Áreas afectadas por procesos naturales y antrópicos)	0	0%
Total	81,238	100%

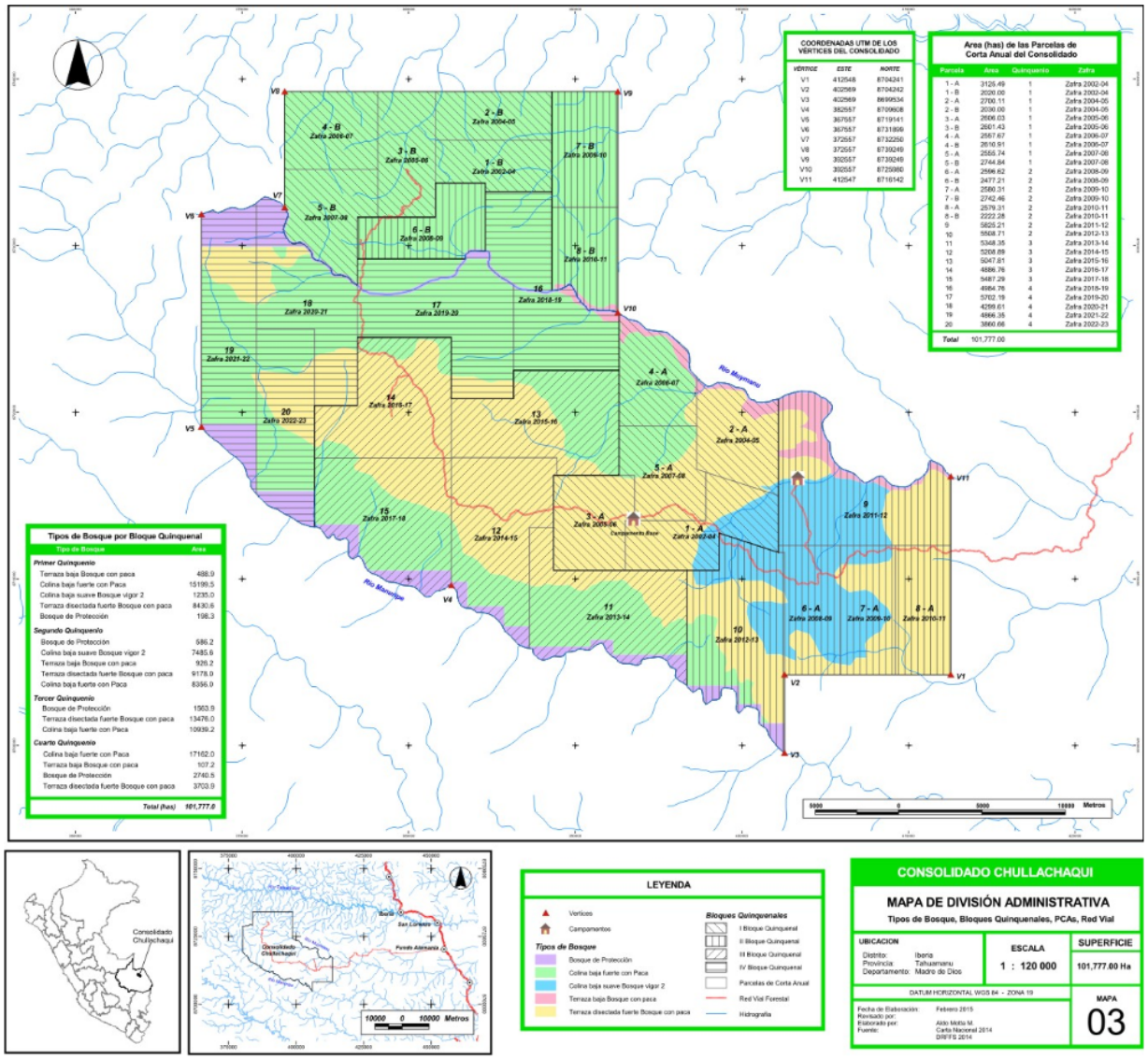
Source: PGMF Otorongo, 2018. Page 10

MAP 14: PLANNING AND FOREST STRATIFICATION IN OTORONGO – FOREST SAMPLING PLOTS LOCATION



Source: PGMF Otorongo, 2018

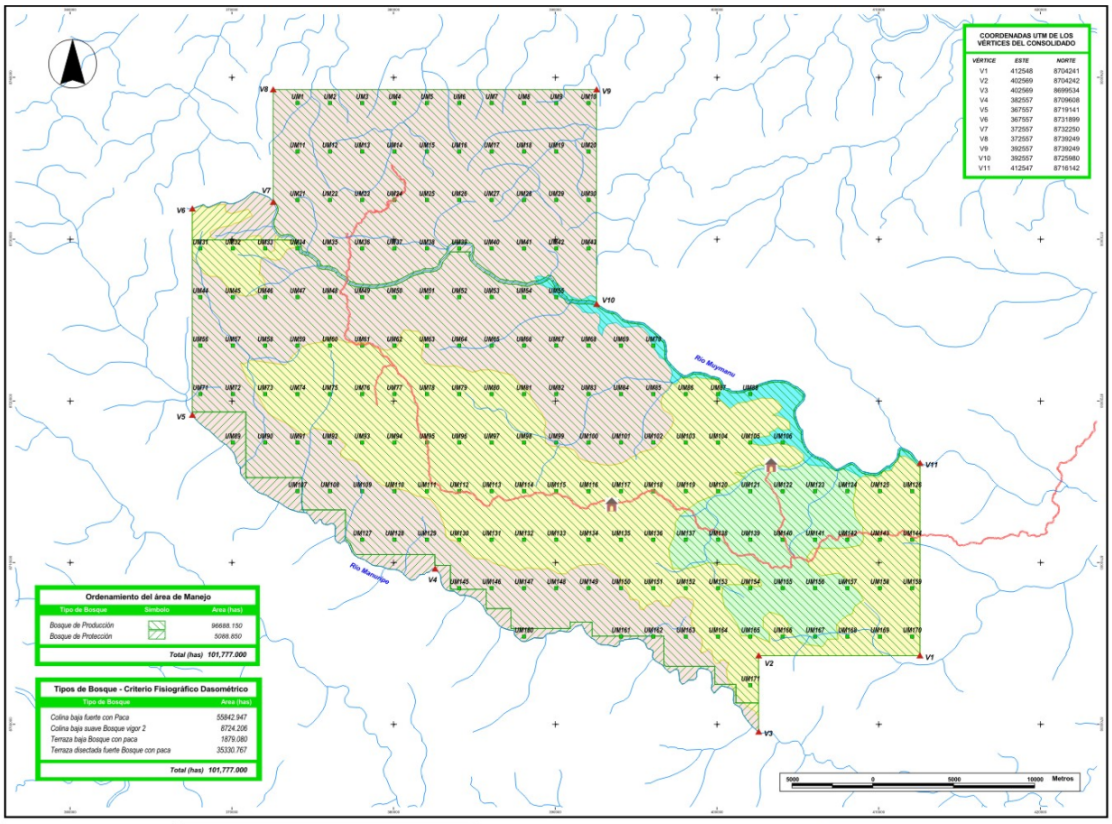
Map 15: CHULLACHAQUI CONSOLIDATED ADMINISTRATIVE DIVISION



Source: PGMF Chullachaqui 2018

These 5-years blocks are divided in Annual Logging Plots (PCA), each one corresponding to an annual Zafra.

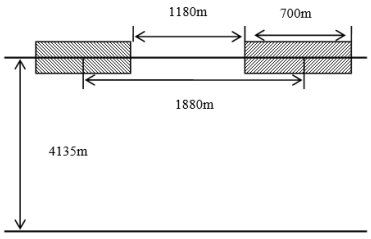
Map 16: Planning and Forest Stratification in Chullachaqui – Forest Sampling Plots Location



Source: PGMF Chullachaqui 2018

In general, an exploratory inventory is carried out on plots systematically arranged throughout the whole area of the Consolidated following the guidelines of the Field Instruction. The design of the inventory is systematic stratified, with lines and plots equidistant from each other, with a line and line distance of 4135 m; and between the center of the plot and the next plot of 1880m.

CHART 5: SHAPE OF EXPLORATORY INVENTORY PLOTS



The shape of the plot is rectangular 20 m wide by 700 m long. Where all trees greater than 20 cm of DAP will be recorded. Also, subplots will be made for the evaluation of natural regeneration, 10x10m for fustals (10 cm and < 20 cm)[21]; 5x5m for latizals and 2x2m for flanges. With this information you will be able to obtain the administrative división map where sampling units are grouped in a specific harvesting block. From each block, the list of species to be managed (average commercial volume per hectare) is

[21] También se consideran las palmeras y su regeneración, solo altura total.

determined, the trees of future harvest (species of commercial interest), the species present as natural regeneration and the volume of allowable logging to extract in each Block can be obtained, which is presented in the following table. In addition, important information is obtained from non-timber forest species (Brazil nut, rubber, etc.) and information on sites of interest to wildlife.

TABLE 43: VOLUME OF ALLOWABLE ANNUAL LOGGING (VCAP) PER FOREST MANAGEMENT UNIT (UMF)

Volumen de la corta anual permisible (VCAP) para el tercer bloque quinquenal

Tipo de Bosque	AFP		Vcp m3/ha	Vcp ponderado m3	VCAP m3
	Ha	%			
Colina baja fuerte con Paca	10,939.215	44.80	43.427	986,252.368	197,250.474
Terraza disectada fuerte Bosque con paca	13,475.994	55.20	37.935		
Total	**24,415.209**	**100.00**	**40.395**		

Source: PGMF Chullachaqui 2018

Allowable annual logging volumes are those presented in the PGMF of each consolidated according to trees of commercial interest, the minimum cut diameter (DMC) and has a horizon of 20 years presented by each five-year block by forest type.

To ensure the natural regeneration of species of commercial interest, the harvest projection (sustainability calculation) is carried out where the number of individuals that can be used in the future is basically calculated, where this number must be greater than or equal, to the number of trees used today; and the reconstitution rate (%Re) that allows you to define the degree of forest recovery, after a certain time. All these calculations are performed in an Excel matrix presented in the "Forestry Plan" over a 100-year horizon (5 cutting cycles).

The forest management implemented in Consolidated Chullachaqui is the same used in Consolidated Otorongo. The project proponent employs a polycyclic forest management system of entresaca. Polycyclic because it has a logging cycle of 20 years (time lapse required for the recovery and next logging cycle); entresaca because only desirable species competing with future harvest species were cut and harvesting would work as the first forest treatment, promoting natural regeneration by the clearings that were formed. Logging planning has been divided into five-year blocks and each consolidated has 4 blocks as can be seen in the following map and also is characterized by forest types: protection; strong low hill with paca; soft low hill; low forest terrace with paca and strong dissected terrace forest with paca (yellow).

Logging is carried out with cyclic entrances to the same area, being the first cycle of 20 years and the following, will be defined based on existing natural regeneration and recoverability. For species requiring recovery times greater than 20 years, they shall be grouped according to this value, in order to define which species have been recovered and are suitable to be harvested in each of the cycles.

Each block represents a five-year period and is subdivided into cutting plots (PC) that represent the harvest cycle, for the Consolidated Chullachaqui from the beginning of the project (2018) entered the fourth five-year period, that is, the last block of this 20-years harvest cycle. Once the exploitation in PC 20 (A and B) is finished; Harvesting will begin in PC01, which has already been out for 20 years since harvesting. The logging plots to be harvested are the following:

Table 44. Logging plot area, Consolidated Chullachaqui

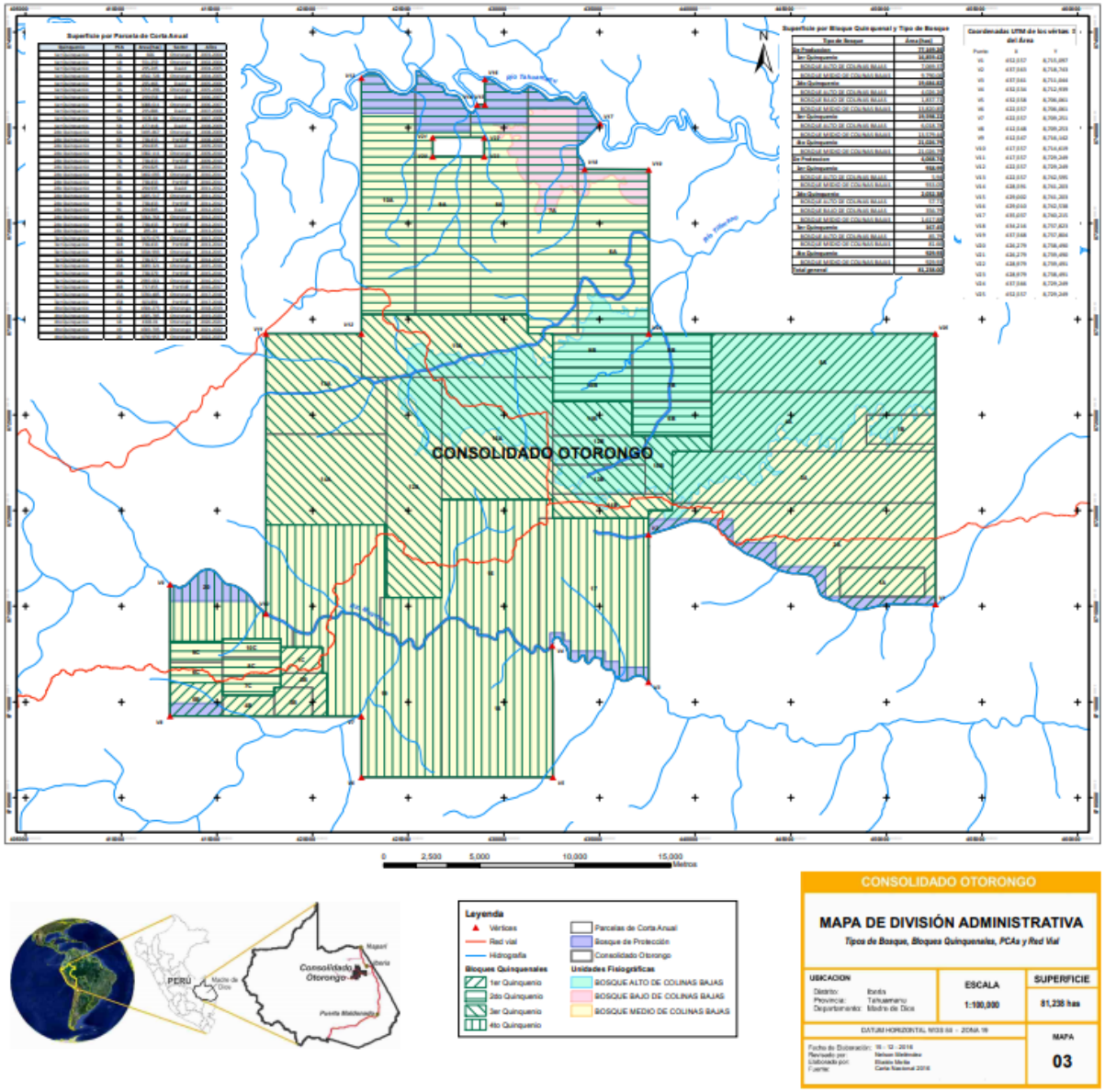
Cuarto Bloque Quinquenal

PC	Tipo de bosque	AFP	
		Ha	%
16	Colina Baja Fuerte con Paca	4,748.903	22.64
16	Terraza Baja Bosque con Paca	107.230	0.51
17	Colina Baja Fuerte con Paca	5,024,162	23.96
17	Terraza Disectada Fuerte Bosque con Paca	441.360	2.10
18	Colina Baja Fuerte con Paca	2,423.368	11.55
18	Terraza Disectada Fuerte Bosque con Paca	1,321.077	6.30
19	Colina Baja Fuerte con Paca	2,683.075	12.79
19	Terraza Disectada Fuerte Bosque con Paca	834.614	3.98
20	Colina Baja Fuerte con Paca	2,282.469	10.88
20	Terraza Disectada Fuerte Bosque con Paca	1,106.831	5.28
Total AFP Bloque IV		**20,973.089**	**100.0%**

Total	**Total AFP de los Bloques I – IV**	**96,688.149**	95.0%
	Total áreas no productivas	**5,088.851**	5.0%
	Área total de la concesión	**101,777.00**	100.0%

Source: PGMF Otorongo, 2018. Page 14

Map 17: OTORONGO CONSOLIDATED ADMINISTRATIVE DIVISION



Source: PGMF Otorongo 2018

In the same way, the Consolidated Otorongo in 2018 also entered the fourth five-year period, with the following plots to take advantage of:

Table 45. Area of each logging plot, Consolidated Otorongo

Cuarto Bloque Quinquenal

PC	Tipo de bosque	AFP	
		Ha	%
16	BOSQUE MEDIO DE COLINAS BAJAS	4,247.15	20.2%
17	BOSQUE MEDIO DE COLINAS BAJAS	4,005.82	19.1%
18	BOSQUE MEDIO DE COLINAS BAJAS	4,264.56	20.3%
19	BOSQUE MEDIO DE COLINAS BAJAS	4,252.81	20.2%
20	BOSQUE MEDIO DE COLINAS BAJAS	4,256.46	20.2%
Total AFP Bloque IV		**21,026.79**	**100.0%**

Total	**Total AFP de los Bloques I – IV**	**77,169.26**	95.0%
	Total áreas no productivas	**4,068.74**	5.0%
	Área total de la concesión	**81,238.00**	100.0%

Source: PGMF Otorongo, 2018. Page 13.

Allowable annual logging volumes are those presented in the PGMF of each consolidated according to trees of commercial interest, the minimum cut diameter (DMC) and has a horizon of 20 years presented by each five-year block by forest type.

TABLE 46: VOLUME OF ALLOWABLE ANNUAL LOGGING (VCAP) PER FOREST MANAGEMENT UNIT (UMF)

Volumen de la corta anual permisible (VCAP) para el cuarto bloque quinquenal

Tipo de Bosque	AFP		Vcp m3/ha	Vcp ponderado m3	VCAP m3
	Ha	%			
Bosque medio de colinas bajas	21,026.794	100.0	32.795	**689,573.709**	**137,914.742**
Total	**21,026.794**	**100.0**	**32.795**		

Source: PGMF Otorongo 2018, page 49

Although it is true that it is allowed to extract these maximum volumes in each Consolidated in this fourth five-year period, this may be less due to the fact that 20% of seed trees are left and the intensity of cutting (IC%) for each species usually borders 80%, and thus ensure its return in time. In addition, the area to be effectively harnessed is determined on the PC, since areas of importance for fauna, road areas (main and secondary), log yards, etc. are also identified.

The projection of the harvest using the Harvest Projection Simulator Software was verified by the competent authority for the approval of the Management Plan and the Forest Harvesting Plan every time the forest was entered for harvesting. In the following tables the harvest is projected for both consolidated.

Table 47: Harvest Projection, Consolidated Chullachaqui

Clases	No/ha	Cosechas																				
		Año1	Año2	Año3	Año4	Año5	Año6	Año7	Año8	Año9	Año10	Año11	Año12	Año13	Año14	Año15	Año16	Año17	Año18	Año19	Año20	Año21	
30-40	0.023																						
40-50	1.661																					0.023	
50-60	2.012	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	1.661	
60-70	2.398	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12		
70-80	1.766	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09		
80-90	1.170	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06		
90-más	2.292	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11		
Árboles a cortar (80%)		**0.39**	**0.39**	**0.39**	**0.39**	**0.39**	**0.39**	**0.39**	**0.39**	**0.39**	**0.39**	**0.39**	**0.39**	**0.39**	**0.39**	**0.39**	**0.39**	**0.39**	**0.39**	**0.39**	**0.39**	**1.329**	**3.26**
Árboles semilleros (20%)		**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**		**0.65**

Source: PGMF Chullachaqui 2018, page 49

Table 48: Harvest Projection, Consolidated Otorongo

Clases	N°/ha	Cosechas																				
		Año 1	Año 2	Año 3	Año 4	Año 5	Año 6	Año 7	Año 8	Año 9	Año 10	Año 11	Año 12	Año 13	Año 14	Año 15	Año 16	Año 17	Año 18	Año 19	Año 20	Año 21
A (20-29)	29.98	29.98																			29.98	29.98
B (30-39)	18.07	18.07																			18.07	29.98
C (40-49)	9.40	9.40																			9.40	18.07
D (50-59)	4.98	4.98																			4.98	9.40
E (60-69)	3.88	3.88																			3.88	4.98
F (70-79)	2.42	2.42	2.376	2.327	2.279	2.23	2.182	2.134	2.085	2.037	1.988	1.94	1.891	1.843	1.794	1.746	1.697	1.649	1.6	1.552	1.503	3.88
G (80-89)	2.36	2.36	2.315	2.268	2.221	2.174	2.126	2.079	2.032	1.985	1.937	1.89	1.843	1.796	1.748	1.701	1.654	1.607	1.559	1.512	1.465	1.50
H (90 a más)	3.12	3.12	3.056	2.993	2.931	2.869	2.806	2.744	2.682	2.619	2.557	2.495	2.432	2.37	2.307	2.245	2.183	2.12	2.058	1.996	1.933	1.46
Árboles a cortar (%)		**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**
Árboles semilleros (%)		**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**

Source: PGMF Chullachaqui 2018, page 50

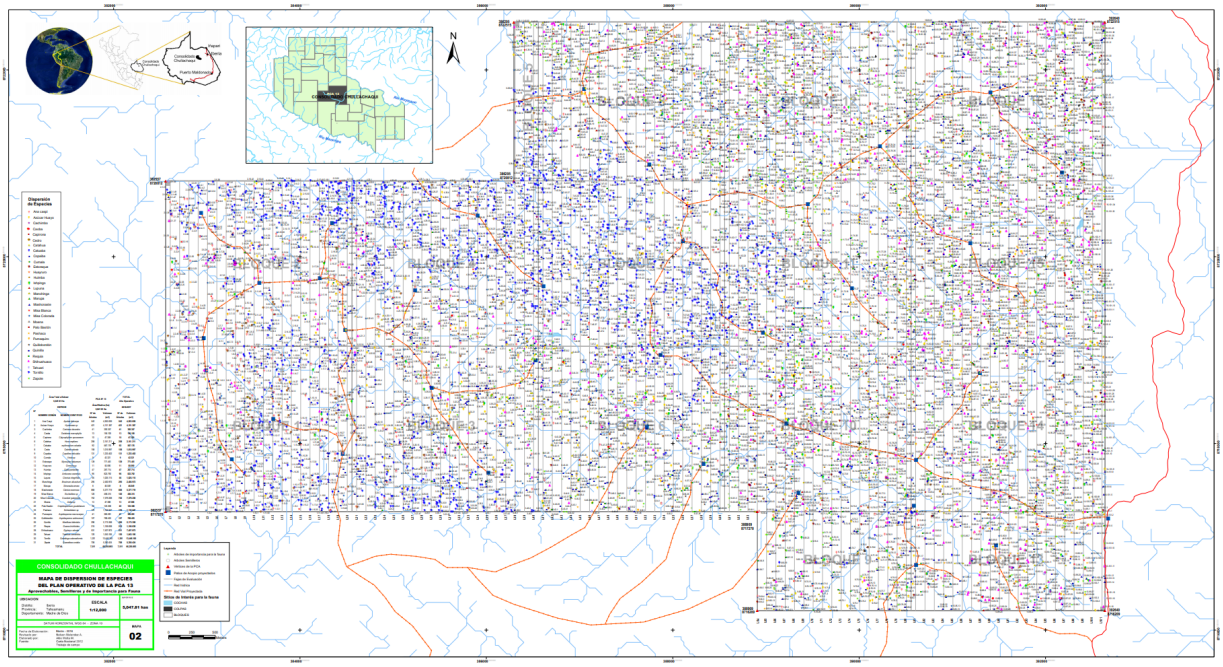
In the PGMF, the basis for logging is obtained. The Operational Plan is the one that presents the most detail and importance for forest harvesting, as it is required for the approval of the volumes to be extracted in the felling plot and all operations for harvesting are presented. The OP is carried out one year before entering a specific PC and requires 100% data collection (forest census). Having these data, it is only possible to determine the species and number of individuals to be harvested and those that will be left for a future harvest or because of their ecological importance (seedbeds, species of importance for fauna, etc.), protection areas, design of the roads, log yards, campsites, etc. Likewise, the volume calculated for harvesting is not 100% withdrawn and with respect to CITES species such as Mahogany and Cedar, the harvesting quota is determined by the State.

3.1.2.1.1 Forest logging

For the approval of operational plan, a census has been carried that measure 100% of tres. This work is outsourced and then a QA/QC is done by the Company. A protocol has been developed for this step.

After ending the census, a detailed map is prepared with the location of each tree within the logging parcel, per specie, seedling trees, future harvest trees, road network design, protected areas, etc. Maps elaborated during census are shown below:

Map 18: CHULLACHAQUI- SCATTER MAP FOR PC13



Source: POA Chullachaqui, 2018

Table 49: Trees and volume to be harvested, Consolidado Chullachaqui

	Área Total a Extraer 5,047.81 Ha		PCA N° 13		TOTAL Año Operativo	
	ESPECIE		Área Efectiva (ha) 5,047.81 Ha		2016-2017	
N°	NOMBRE COMÚN	NOMBRE CIENTIFICO	N° de Árboles	Volúmen (m3)	N° de Árboles	Volúmen (m3)
1	Ana Caspi	*Apuleia leiocarpa*	542	4,953.059	542	4,953.059
2	Azúcar Huayo	*Hymenaea sp*	421	4,101.387	421	4,101.387
3	Cachimbo	*Cariniana decandra*	41	392.357	41	392.357
4	Caoba	*Swietenia macrophylla*	13	156.100	13	156.100
5	Capirona	*Calycophyllum spruceanum*	10	47.359	10	47.359
6	Catahua	*Hura crepitans*	258	2,161.211	258	2,161.211
7	Catuaba	*erythroxylum catuaba*	92	567.176	92	567.176
8	Cedro	*Cedrela odorata*	158	1,015.997	158	1,015.997
9	Copaiba	*Copaifera reticulata*	131	1,233.402	131	1,233.402
10	Cumala	*Virola sp*	9	42.321	9	42.321
11	Estoraque	*Myroxylon balsamum*	139	771.461	139	771.461
12	Huayruro	*Ormosia sp*	11	50.590	11	50.590
13	Huimba	*Ceiba pentandra*	47	267.714	47	267.714
14	Ishpingo	*Amburana cearensis*	96	823.792	96	823.792
15	Lupuna	*Chorisia integrifolia*	56	1,025.115	56	1,025.115
16	Manchinga	*Brosimum alicastrum*	295	2,400.973	295	2,400.973
17	Marupa	*Simarauba amara*	8	46.049	8	46.049
18	Mashonaste	*Clarisia racemosa*	868	5,377.719	868	5,377.719
19	Misa Blanca	*Eschwilera sp*	120	458.315	120	458.315
20	Misa Colorada	*Couratari guianensis*	752	7,379.258	752	7,379.258
21	Moena	*Aniba sp*	13	47.388	13	47.388
22	Palo Bastón	*Crepidospermum goudotianum*	22	123.308	22	123.308
23	Pashaco	*Schizolobium sp*	170	1,132.547	170	1,132.547
24	Pumaquiro	*Aspidosperma macrocarpon*	41	365.281	41	365.281
25	Quillobordón	*Aspidosperma subincanum*	127	768.453	127	768.453
26	Quinilla	*Manilkara bidentata*	296	2,173.358	296	2,173.358
27	Requia	*Guarea trichiloides*	215	1,106.638	215	1,106.638
28	Shihuahuaco	*Dypteryx odorata*	531	7,427.873	531	7,427.873
29	Tahuari	*Tabebuia serratifolia*	120	1,043.106	120	1,043.106
30	Tornillo	*Cedrelinga catenaeformis*	1,201	13,446.160	1,201	13,446.160
31	Zapote	*Quararibea cordata*	708	5,350.424	708	5,350.424
	TOTAL		7,511	66,255.893	7,511	66,255.893

Source: POA Chullachaqui, 2018

Table 50: Trees and volume to be harvested, Consolidado Otorongo

	Área Total a Extraer 4304.376 Ha ESPECIE		PCA Nº 15 Sector OTORONGO Área Efectiva (ha) 3700.485 Ha		Sector PORTILLO Área Efectiva (ha) 603.891 Ha		TOTAL Año Operativo 2017-2018 4304.376 Ha	
Nº	NOMBRE COMÚN*	NOMBRE CIENTIFICO*	Nº de Árboles	Volúmen (m3)	Nº de Árboles	Volúmen (m3)	Nº de Árboles	Volúmen (m3
1	Ana Caspi	*Apuleia leiocarpa*	293	2,526.61	35	310.291	**328**	**2,836.90**
2	Azúcar Huayo	*Hymenaea oblongifolia*	310	3,057.86	43	414.201	**353**	**3,472.06**
3	Cachimbo blanco	*Cariniana decandra*	48	461.622	7	68.904	**55**	**530.526**
4	Capirona	*Calycophyllum spruceanum*	82	416.617	14	66.256	**96**	**482.873**
5	Catahua	*Hura crepitans*	161	1,467.98	69	626.915	**230**	**2,094.90**
6	Catuaba	*Erythroxylum catuaba*	37	175.449	4	17.541	**41**	**192.99**
7	Cedro	*Cedrela odorata*	16	86.267	3	16.405	**19**	**102.672**
8	Copaiba	*Copaifera reticulata*	95	939.459	22	268.003	**117**	**1,207.46**
11	Estoraque	*Myroxylon balsamum*	171	941.707	44	245.127	**215**	**1,186.83**
12	Guacamayo Caspi	*Simira rubescens*	0	0	41	215.109	**41**	**215.109**
14	Huimba	*Ceiba samauma*	136	734.223	36	241.978	**172**	**976.201**
15	Ishpingo	*Amburana cearensis*	96	742.957	14	101.682	**110**	**844.639**
17	Lupuna	*Ceiba pentandra*	49	1,186.53	7	229.642	**56**	**1,416.17**
18	Machinga	*Brosimum alicastrum*	182	1,596.67	88	733.828	**270**	**2,330.49**
19	Marupa	*Simarouba amara*	16	75.516	5	24.856	**21**	**100.371**
20	Mashonaste	*Clarisia racemosa*	306	1,658.71	45	223.853	**351**	**1,882.56**
22	Cachimbo	*Couratari guianensis*	150	1,221.70	19	177.431	**169**	**1,399.13**
24	Palo Bastón	*Crepidospermum goudotianum*	48	289.923	8	42.846	**56**	**332.769**
25	Pashaco	*Schizolobium amazonicum*	76	491.866	0	0	**76**	**491.866**
26	Pumaquiro	*Aspidosperma macrocarpon*	16	135.462	3	26.791	**19**	**162.253**
27	Quillobordón	*Aspidosperma vargasii*	68	407.921	9	46.577	**77**	**454.498**
28	Quinilla	*Manilkara bidentata*	109	889.875	31	249.133	**140**	**1,139.01**
29	Requia	*Guarea kunthiana*	115	603.145	9	38.33	**124**	**641.475**
30	Shihuahuaco	*Dipteryx odorata*	518	6,294.04	111	1,663.60	**629**	**7,957.64**
31	Tahuari	*Tabebuia capitata*	74	611.233	6	50.775	**80**	**662.008**
33	Sapote	*Matisia cordata*	309	2,197.75	103	702.236	**412**	**2,899.99**
	TOTAL		**3,481**	**29,211.10**	**776**	**6,802.31**	**4257**	**36,013.40**

Source: POA Otorongo, 2018

On reduced impact logging (AIR), it consists of the implementation of carefully planned and controlled extraction in the field in order to minimize the impact on the remnant forest and soil. In general, it is required to develop: maps to locate the trees to be extracted (Species Scatter Map), main characteristics of the terrain and areas of protection; proper planning and construction of roads, trawl tracks and location of collection yards; cutting vines and bejucos; use of directed logging techniques and correct cutting of logs; dragging the logs from the tracks, trying to reduce the presence of the tractor in the forest; protection of the plant layer and watercourses, the establishment of transverse drains in the road network and buffer zones near watercourses and the stopping of operations when it rains.

Before logging operations, a 100% commercial forest census is carried out on each PCA and the following parameters are recorded in detail:

- Harvestable trees (volume harvestable according to the DMC[22]), future harvest, seedling trees, trees of species of importance to the fauna and trees of non-timber forest species (UTM location and dimensions)
- Dasometric information of individuals of commercial species from 30 cm; CITES species (Cedar and Mahogany) from 10 cm.
- Pruning of bejucos and vines of all harvestable individuals and seedbeds
- Information of important sites for wildlife (drinkers, feeders, colpas, etc.)
- Wildlife watching during the census.

Required: libretist (brigade chief), materos; equipment (radio, GPS, camera, reflective vest, gloves, first aid kit); tools (machetes, PCA base map and list of census species data and their DMC) and materials (water tape, indelible down, 3x5cm aluminum plates, 2.5" nails, small hammer, pencil, brush, census registration format).

On the planning of the use, the following is detailed:

LOGGING OPERATIONS, under controlled felling techniques where seedlings, remnants trees, future harvest trees and trees of high conservation values will be protected. The activity will start 1 week before dragging. This operation is divided:

Pre-Logging, it is done before lying down the tree: check the direction of fall of the tree; clean around the trunk for easy handling of the chainsaw; prepare the escape route; cut vines and any vegetation that prevents the tree from falling freely.

Logging (lying down from the harvestable trees), the chainsaws will have the map of scattering trees to take advantage of, indicating the direction of fall and this will serve as the basis for the planning of the trawl.

Then, it consists of separating the cup from the usable fuse leaving it ready for drag or jogging. Special care at this stage to avoid defects by branches or gaps.

Trozado (cutting), consists of sectioning the shaft into logs whose size will be according to the diameter of the tree used, the type of transport vehicle and the demands of the market. The jog is usually performed in the bulking yard, although sometimes it will be necessary to chop the fuses at the foot of the stump, in order to prevent the Skidder from making efforts and lessening the damage to the forest.

Depending on the number of trees to be used, the requirement will be made in terms of personnel, equipment, machinery and materials to the corresponding area. In general, you will need: specialized personnel (chainsaws) and assistants. As well as, Stihl 600 chainsaws; helmets for chainsaws and helmets, ear protectors, chainsaw gloves, chainsaw yaws, reinforced shoes; trousers for chainsaws; machetes, chainsaw maintenance equipment, wedge set and specialized medicine cabinet.

CONSTRUCTION OF ROADS: Accesses, main and secondary roads. Necessary personnel: engineer (management and planning coordinator), field supervisor (forest manager), road stroke manager, road openers, chainsaw, Articulated Forest Tractor operator (Skidder), front loader operator, track tractor operator, motor saw operator, chainsaw assistant and operator assistants. Machinery to be used: chainsaw, articulated forestry tractor, front loader, track tractor and motor leveler.

[22] Los Diámetros mínimos de corta (MDC) son establecidos por el Estado y por lo general el DMC promedio es de 40 cm, salvo excepciones como Cedro (65cm) y Caoba (75cm). y la empresa tiene DMC superiores para algunas especies.

DRAGGING OPERATIONS, process of moving the fuses or logs from the logging area to a loading yard. The drag will be planned based on the topographic information and location of the lying trees. The chainsaws will indicate in the Tree Scatter Map, the fall of the tree and the number of logs that will serve as information for the Skidder operator. Staff will be required to operate the Skidder with the support of assistants. Machinery: Skidder.

LOADING AND TRANSPORT OPERATIONS, logs dragged into collection yards will be stacked by species with the help of the front loader that will also be used to load the logs to the truck. Necessary personnel: front loader operator, assistant and roll wood dispatcher; machinery: front loader.

Special care in each PCA on CITES species found and those that require special treatment. The seedlings and short of bejucos and vines will be marked during the Census. Materos (tree classification) will be required for tree placement, bejuco and vine placement; GPS, chainsaw, machete and axes.

To ensure the natural regeneration of species of commercial interest, the harvest projection (sustainability calculation) is carried out where the number of individuals that can be used in the future is basically calculated, where this number must be greater than or equal, to the number of trees used today; and the reconstitution rate (%Re) that allows you to define the degree of forest recovery, after a certain time. All these calculations are performed in an Excel matrix presented in the "Forestry Plan" over a 100-year horizon (5 cutting cycles).

The following table details the main values of the parameters used for the harvest projection analysis of the 8 species of interest for both consolidated, except in the case of Tornillo for the Otorongo consolidated. Detailed information in the Silvicultural Plan for each Consolidated.

Table 51: Species management Data

SUSTENTO DE MANEJO DE LAS ESPECIES										
Nombre comun	Nombre cientifico	Diámetro Mínimo de Corta (cm)	Ciclo de Corta	Intensidad de corta	Densidad de extracción (Ind/ha)	Indice de remanencia	% Reconstitución	% Reconstitución (consolidado	Ciclo de recupero (años)	Rotación incio de recupero
Ana caspí	*Apuleia leiocarpa*	41	60	50	0.201	50	101	90	60	3
Azucar Huayo	*Hymenaea oblongifolia*	55	50	23	0.093	77	113	103	60	1
Caoba	*Swiethenia macrophylla*	75	70	24	0.001	76	102	114	70	2
Cedro	*Cedrela odorata*	65	20	50	0.029	50	101	309	20	1
Estoraque	*Myroxylon balsamum*	45	25	50	0.204	50	101	100	25	2
Ishpingo	*Amburana cearensis*	56	50	43	0.086	57	100	162	50	3
Misa o Cachimbo	*Couratari guianensis*	41	30	78	0.121	22	104	105	30	1
Mashonaste	*Clarisia racemosa*	41	90	78	0.503	22	103	106	90	1
Pumaquiro	*Aspidosperma macrocarpon*	53	35	44	0.038	56	100	102	35	3
Quinilla	*Manilkara bidentata*	41	20	40	0.357	60	104	197	20	1
Shihuahuaco	*Dipteryx odorata*	75	73	72	0.154	28	100	137	73	4
Tahuari	*Tabebuia serratifolia*	56	26	50	0.184	50	130	104	26	1
Tornillo	*Cedrelinga cateniformis*	80	50	70	0.124	30	83	123	50	1

Source: Plan silvicultural Chullachaqui, Otorongo. 2018

As can be seen, the Reconstitution Percentage is close to 100% for almost all species, which indicates that the species are capable of recovering at the specified harvest intensities in a period of at least 20 years, that is, they are in the ability to provide an equal or greater quantity for the next harvest. Likewise, it can be observed that the Reconstitution Percentage (consolidated) is also close to 100%; However, for this to happen, it is necessary for some species from the third cutting cycle to change the rotation period to one greater than 20 years, which is known as the recovery cycle. After the “mahogany”, the “shihuahuaco” is the one that presents the greatest regeneration problems, this can be seen when observing the diameter distribution curve that it develops. It requires a longer recovery period, which is why after the first cutting cycle of 20 years, recovery cycles of 73 years should be implemented, that is, the use of this species will cease, leaving more time for its Recovery. Finally, as we know, the management system proposed for Inversiones Forestales Chullachaqui is of the polycyclic type of thinning, based on natural regeneration and taking into account the DMC regulated by the State and in some cases, a DMC higher than that indicated by the State, proposed by the company. That is, the use is made with cyclical income to the same area, with the first cycle of 20 years and the following will be defined based on the existing natural regeneration and recovery capacity. In the case of species that require recovery times greater than 20 years, they will be grouped based on this value, in order to define which species have recovered and are suitable for use in each of the cycles. Given that some species require long periods, so that at the defined harvest intensity they can recover, it is necessary to incorporate new species, to cover the volume, no longer available, of the species that require entering a resting stage to its recovery, incorporating into the system, a mechanism of species rotation. It is important to carry out this analysis for each of the species that are or will be included in the harvest.

The silvicultural treatments carried out are:

- Harvesting of thinning is considered the first and most important silvicultural treatment, since through the harvest of mature trees for commercial purposes, the canopy is opened and the basal area is reduced, reducing competition per site. characterized by being correctly planned. Forest harvesting in our company basically consists of the following activities: commercial census, layout and construction of the road network, controlled logging, reduced impact dragging, controlled transport, and other details of the operation, as well as post-harvesting measures, that is to say, closure of roads, cleaning of water courses and collection of inorganic waste. The success of the system consists in keeping the impacts to vegetation, soil and water within acceptable limits, and on the other hand, maintaining the potential of the remaining forest ready to react with the openings created by the operation.
- The planning of harvesting operations is a crucial point to guarantee the sustainability of the forest. To achieve this, it is necessary to have hydrographic and physiographic information on the terrain, as well as dasometric, distribution and location of usable trees, trees to protect and uses other than wood. This information is prepared to carry out the commercial census, and its analysis will be detailed in the operational plan. Within the planning to be carried out, we determine the usable trees. This activity is directly related to the degree of disturbance that will occur in the forest; consequently, it is a conditioning factor for its recovery. For this reason, when selecting the trees to be harvested, the following criteria must be taken into account: - The trees to be harvested cannot belong to a prohibited species. - Trees with burrows or nests of vulnerable species will not be touched. - They must be located within the effective area of the forest. - They must be accessible for extraction considering the current road network and to be established. - We must ensure that by cutting them down, we do not affect the natural regeneration, seed trees and future harvest trees. - The distribution of the trees to be harvested must be homogeneous, avoiding concentrations.

- - Selection, marking, cleaning and protection of Seed Trees and Trees for future harvest. The Seed Trees are intended to produce seeds for the repopulation of the forest once it has been intervened. The trees for future harvest are the stock that will be available in the following rotations. Both are part of the remaining upper canopies that will reduce the opening of gaps caused by harvesting.
- Seed trees correspond to individuals with similar characteristics to those that can be harvested, therefore, they are straight individuals, without defects and with reproductive maturity, they are above the DMC. Currently the number of seed trees is selected according to the "Guidelines for the preparation of the Operational Plan for forest concessions for timber purposes" (2016) set by the State, corresponding to 20% of the total usable trees by species. When selecting seed trees, a series of characteristics and criteria are taken into account, among others, the following: - Tall trees with a large and dense crown in order to maximize seed dispersal and production. - They must not be weak, not inclined, rotten or hollow, so that their permanence and seed production capacity lasts for several years. - Trees with not very thick diameters, in order to meet the objective of staying in the area for a longer amount of time. In order to guarantee a uniform dispersion of seeds throughout the intervened area, the seedbeds are distributed homogeneously throughout the area, avoiding grouping them in one place. Seedling marking is an activity that is done simultaneously with inventory. The Future Harvest Trees are those that in some cases are above the DMC proposed by the State, but below the commercial / current DMC of the Company. In the seedlings and future harvest trees, lianas and vines are cleaned, in order to eliminate any agent that compromises their growth.

3.1.3 Project Boundary

Define the project boundary and identify the relevant GHG sources, sinks and reservoirs for the project and baseline scenarios (including leakage if applicable).

TABLE 52: GHG EMISSIONS FROM SOURCES NOT RELATED TO CHANGES IN CARBON POOLS (EMISSION SOURCES) TO BE INCLUDED IN THE GHG ASSESSMENT

Source		GHG	¿Included ?	Explanation	Justification
BASELINE	Deforestation and forest degradation baseline	CO2	NO	Emissions are related with changes in carbon pools. Included only when degradation has not been included in the estimation of changes in carbon pools and if they implement activities of CFE	Degradation not included in the estimation of carbon pools but does not implement CFE activities
		CH4	NO	Conservatively omitted, except when CFE activities are implemented.	Does not implement CFE activities.
		N2O	NO	N2O emissions from biomass burning are insignificant and conservatively excluded, except when CFE activities are carried out	Does not implement CFE activities.
PROJECT	Cook stove and fuel efficiency (CFE)	CO2	NO	Emissions are included in changes in carbon pools. Included only when degradation is not included in the estimation of changes in carbon pools	Does not implement CFE activities.

	CH4	NO	CH4 emissions from biomass burning are not significant in CFE activities.	Does not implement CFE activities.
	N2O	NO	CH4 emissions from biomass burning are not significant in CFE activities.	Does not implement CFE activities.
Biomass burning from unexpected at large or short scale	CO2	NO	Emissions are included in changes in carbon pools.	Already included.
	CH4	No	CH4 emissions from biomass burning from unplanned fires are not significant. If fires are catastrophic, CH4 emissions must be estimated to demonstrate insignificance or be accounted	Insignificant. No catastrophic fires registered
	N2O	No	N2O emissions from biomass combustion from unplanned fires are insignificant, except when catastrophic. N2O emissions must be estimated to demonstrate insignificance or be accounted	Insignificant. No catastrophic fires
Fossil fuel used during logging	CO2	No	Emissions from fossil fuel combustion are considered minimum for REDD.	Minimum
	CH4	No	Insignificant	Insignificant
	N2O	No	Insignificant	Insignificant
Biomass harvesting for prevention or combat forest fires	CO2	No	Emissions related with changes in carbon pools are considered	-
	CH4	No	CH4 emissions from biomass removal are significant when planned burn is used for land clearing	-
	N2O	No	N2O emissions from biomass burning are insignificant and are excluded conservatively	-
Biomass harvesting during naturally assisted regeneration	CO2	NO	Emissions related with changes in carbon pools are considered	No Naturally Assisted Regeneration
	CH4	NO	CH4 emissions from elimination of biomass are significant when fire is used to prepare the land for RNA activities	No Naturally Assisted Regeneration
	N2O	No	N2O emissions from biomass burning during RNA activities are assumed insignificant and excluded conservatively	No Naturally Assisted Regeneration
Fertilizer used during enrichment for naturally	CO2	No	Insignificant assumption	No Naturally Assisted Regeneration
	CH4	No	Insignificant assumption	No Naturally Assisted Regeneration.

	assisted regeneration	N2O	No	Insignificant assumption	No Naturally Assisted Regeneration
	Increase of rice production area	CO2	No	Rice production is assumed insignificant	No rice production areas
		CH4	NO	CH4 emissions from rice crop systems are significant	No rice production areas
		N2O	No	Assumed insignificant according to VCS guidelines	No rice production areas
	Increase of fertilizer use	CO2	No	Not applicable	-
		CH4	No	Not applicable	-
		N2O	No	N2O emissions related with the increase of fertilizer use are minimum	No Fertilizers
	Increase of cattle ranching	CO2	No	Not applicable	No grazing
		CH4	NO	CH4 related with the increase of the number of cattle are significant	No grazing
		N2O	NO	N2O emissions related with the increase of cattle ranching are significant	No grazing

No other sources of emissions caused by changes in pools.

TABLE 53: SOURCES, SINKS AND RESERVOIRS

Carbon Pools	Included / Excluded	Justification
Aboveground tree biomass and non-tree biomass	Included	Carbon in tree biomass was calculated for the PA. Above-ground non tree biomass is not significant, based on the results of the inventory made in* the Native Community of Belgica; therefore, it is conservatively omitted. The carbon stocks in post-deforestation biomass were taken from literature.
Belowground biomass	Included	Included. Significant in tropical forests.
Dead wood	Excluded	Not a significant pool, based on the results of the Inventory *made in the Native Community of Belgica, close to the Project Area.
Harvested wood products	Included	The volume of harvested wood is similar in baseline and project case, as it has always been regulated. The use of this wood will be more efficient in project case because FSC certification will be implemented.
Litter	Excluded	According to the Methodology Framework (REDD-MF) and the CP-AB module, this pool is not significant and can be conservatively omitted.
Soil organic carbon	Excluded	The Table 2 of the methodology mentions that the exclusion of this pool is always conservative.

*The inventory mentioned is the one made in Native Community of Belgica. The stratification used in this inventory is based in the Forest Map of the ZEE of Madre de Dios (2009). See T-SIG module for further detail.

Table 54. CARBON POOLS

Pool		Description
Live biomass	Above ground biomass	The whole biomass of alive vegetation, over the soil, including trunks, branches, seeds, flowers and leaves. To facilitate the measurement, the above ground biomass is distinguished between tree AGB and non-tree AGB
	Below ground biomass	Biomass of alive roots with a diameter higher than 2mm. Roots with a smaller diameter are excluded because of its difficulty to distinguish from soil organic matter
Necromasa	Standing dead wood	All the necromasa of standing dead trees and dead stumps with diameter wider than 10 cm
	Non-standing dead wood	All the necromasa of fallen trees and branches with a diameter wider than 10 cm
	Litter	All the necromasa over the soil (leaves, flowers, branches, trunks, fruits and others) not included in dead wood (standing or not), over or within the mineral or organic soil, including humus and detritus

Source: Adapted from the definitions of carbon reservoirs used for AFOLU. IPCC (2006)

Estimations of carbon content in AGB, litter, dead wood in each one of the forest ecozones in Peru, in the framework of the development of the Forest and Wildlife National Inventory.

Methodology

Parameters considered for the calculations

In order to make the calculations, the following on site data collected during the evaluation of the attributes of the forest state were considered.

a. Height: if the tree is ramified, each branch is considered as an individual, in this case the height to consider for the algometric equation is the tree stem height that corresponds to the length of the branch. In case the tree does not have any branches with a DBH bigger than 10 cm, total height is considered for the calculations.
b. Habit: the individuals considered are those with a habit that corresponds to trees, palms and lianas.
c. State of the tree: calculations were done for those individuals whose state corresponds to alive, dead standing tree and stumps.
d. Panel: only the MU corresponding to panel 1.
e. Conversion factor from biomass to carbon: in order to convert the biomass units to carbon a factor conversion was employed which is accepted at international level, and which indicates that for any vegetable structure 0.47[23] of its dry weight (biomass or deadwood) is carbon.
f. Characteristics and shapes of the plots: the source of information for the biomass and carbon content estimations have been the biophysical data collected during the Forest and Wildlife National Inventory (INFFS).
g. Ecozones analyzed: the six corresponding to the sample design of the INFFS.

[23] For current project calculations, 0.50 was used

h. Selection of reservoirs: the carbon from the terrestrial ecosystems is stores in different components called deposits or reservoirs. The following chart describes briefly said reservoirs. The content of carbon corresponding to the aboveground biomass has been considered.
i. Wood density: the assignation of wood density for forestry species in the ecozones was based in the decision criteria indicated in Chart 6. For those cases when there is no information on wood density, a wood density value of 0.64 g/cm^3 was employed by default.
j. Algometric equations: equations employed for biomass calculations are indicated in Table 45
k. Equation to estimate litter
l. Equation to estimate deadwood in lying dead trees

Chart 6: Decision criteria for the assignation of densities

When the identification from the FNI reaches the species level and the reviewed bibliography

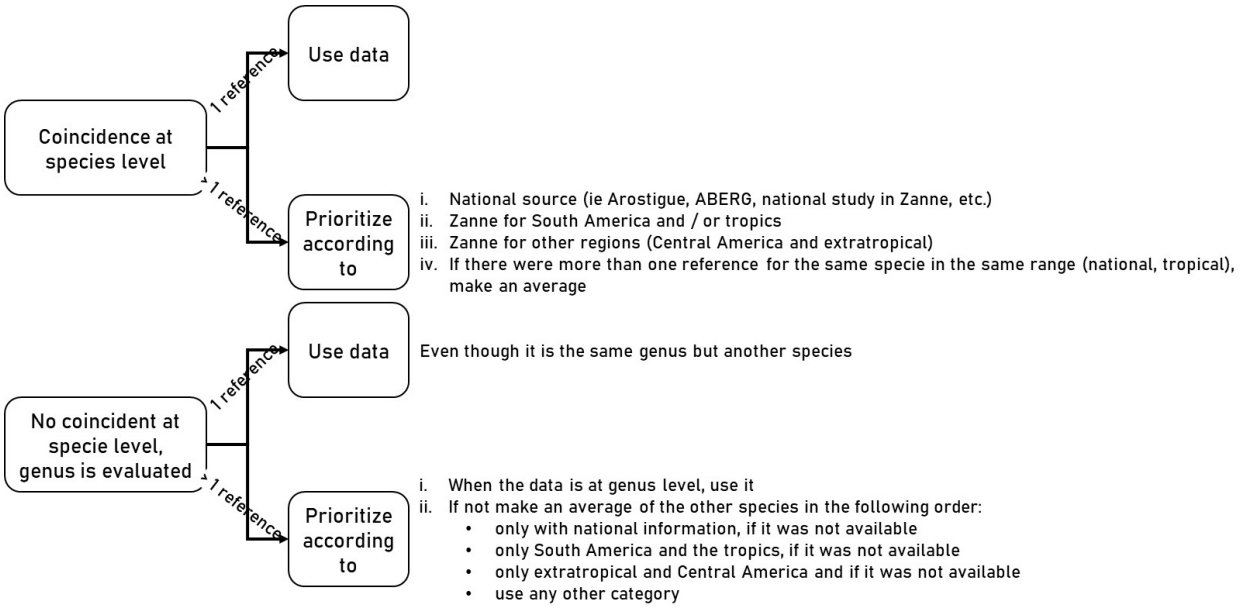


TABLE 55: ALGOMETRIC EQUATIONS FOR THE CALCULATION OF BIOMASS PER ECOZONE

Equation	Ecozone	Region	Reference
0.112 x (p*dap^2*Ht)$^{\wedge 516}$	Coast	Dry forest	Chave et al (2005)
0.112 x (p*dap^2*Ht)$^{\wedge 516}$	Highlands	Dry forest	
P*Exp(-1.239+1.980*Ln(dap)+0.207*Ln(dap)^2-0.0281*Ln(dap)^3)	Selva alta	Wet forest	
P*Exp(-1.499+2.148*Ln(dap)+0.207*Ln(dap)^2-0.0281*Ln(dap)^3)	Selva baja	Moist forest	
P*Exp(-1.239+1.980*Ln(dap)+0.207*Ln(dap)^2-0.0281*Ln(dap)^3)	Hydromorphic	Wet forest	

Where: p=wood density, DAP = diameter at breast height, Ht = total height

In order to estimate litter, the following equation was employed:

$$Bh - Pft * \left(\frac{Psm}{Pfm}\right)$$

Where:

Bh: Biomass in litter (kg)

Psm: Dry weight of the collected sample (kg)

Pfm: Fresh weight of the collected sample (kg)

Ptf: Total fresh weight per sample plot (kg)

Equation to estimate deadwood in lying dead trees

Vol = (π^2)(d_n)^2)/(8*L) (De Vries, 1986)

Where:

dn: diameter of the lying tree (in cm)

L: length of the transect (in meters)

Deadwood = vol*decomposition grade

Calculation results

Note: Estimations in this section are preliminary and subject to confirmation during first verification stage.

Calculations were carried out using the EValidator tool, constructed by the Forestry Service of the United States in the framework of the Project National Forestry Inventory, which considers the statistic design for the sampling of the INFFS. In this way, considering the two-stage design of the INFFS where a paneling effect exists, it was decided to carry out the calculations by means of a reason estimator and the variance that considers the variability of the panels.

Source: Report on the National Forestry and Wildlife Inventory from Peru (2019)

Methods used for estimating carbon stocks

Note: Estimations in this section are preliminary and subject to confirmation during first verification stage.

Carbon stocks in the living above-ground biomass of trees were calculated using the algometric equations shown in Table 56. These equations were selected through a collaborative effort of the technical teams of MINAM's REDD+ project, the National Forest Conservation Program for Climate Change Mitigation (PNCBMCC), the General Directorate for Climate Change, Desertification and Hydrological Resources (DGCCDRH), the General Directorate of Evaluation, Valuation and Financing of the Natural Heritage

(DGEVFPN) and of the National Forestry Inventory (INF) and will also be used in the context of the National Forest Inventory.

TABLE 56: ALLOMETRIC EQUATIONS AND DEFAULT PARAMETERS USED FOR ESTIMATING CARBON STOCKS IN THE LIVING BIOMASS OF TREES

Equation or Factor	Application in Peru	IPCC climatic zone	Reference
Above-ground biomass in trees (AGB.t)			
$0.112 * (\rho * dbh^2 * h)^{0.916}$	*Costa* and *Sierra*	Dry forest	Chave *et al.*, 2005
$\rho * Exp(-1.239 + 1.980 * \ln(dbh) + 0.207 * \ln(dbh)^2 - 0.0281 * \ln(dbh)^3)$	*Selva Alta* and *Zona Hidromórfica*	Wet forest	Chave *et al.*, 2005
$\rho * Exp(-1.499 + 2.148 * \ln(dbh) + 0.207 * \ln(dbh)^2 - 0.0281 * \ln(dbh)^3)$	*Selva Baja*	Moist forest	Chave *et al.*, 2005
$6.666 + 12.826 * h^{0.5} * \ln(h)$	Tall Palms (h>11m)		Pearson *et al.*, 2005
$23.487 + 41.851 * \ln(h)^2$	Small Palms (h≤11m)		Pearson *et al.*, 2005
$10^{(0.12 + 0.91 * \log(BA))}$	*Vines*		Putz, 1983
Below-ground biomass in trees (BGB.t)			
$BGB.t = 0.489 * AGB.t^{0.890}$	All		Mokany *et al.*,2006
Default parameters			
0.47	Default carbon fraction		IPCC, 2006
0.64	Default wood density		Average[15]
44/12	Stoichiometric ratio to convert tons of C to tons of CO_2-e		

Where: **ρ** = Wood density; **dbh** = Diameter at breast height; **h** = Tree height; **BA** = Basal area; **AGB.t** = Above-ground living tree biomass; **BGB.t** = Below-ground living tree biomass.

SOURCE: FREL (2016)

Sampling design

The design of a statistical design has the objective of selecting the samples that represent each sub-population and the whole population in interest. In this way, the sampling design of the INFFD is "systematic, spatially not aligned, distributed in panels with sub-samples grouped in units of uneven size" (MINAGRI *et al.,* 2014).

The most efficient method of spatial distribution of the sample units was found in order to minimize costs and estimation errors (McRoberts *et al*, 2014).

During the process of configuration of the measuring plots and the calculation of the sample size (MINAGRI, *et al* 2014), the calculation of the sample size that is required to reach the accuracy objective in each sub-population was described. The result of this calculation is shown in chart 57, where each sub-population presents a different sample size based influenced by i) accuracy objectives ii) variability of the main

attributes iii) configuration of the sampling plot iv) the forest area assigned to comply with the accuracy objectives v) accessibility and vi) costs of onsite work.

TABLE 57. SIZE OF THE SAMPLE PER SUB-POPULATION AND AVERAGE DISTANCE OF THE SAMPLING PLOTS

Ecozone	Total SP	Size of the grid
Selva baja	808	24
Hydromorphic	91	31
Accesible selva alta	288	20
Selva alta with difficult accessibility	101	34
Coast	460	19
Highlands	5545	0
Total, population	7293	

Source: FAO, 2014

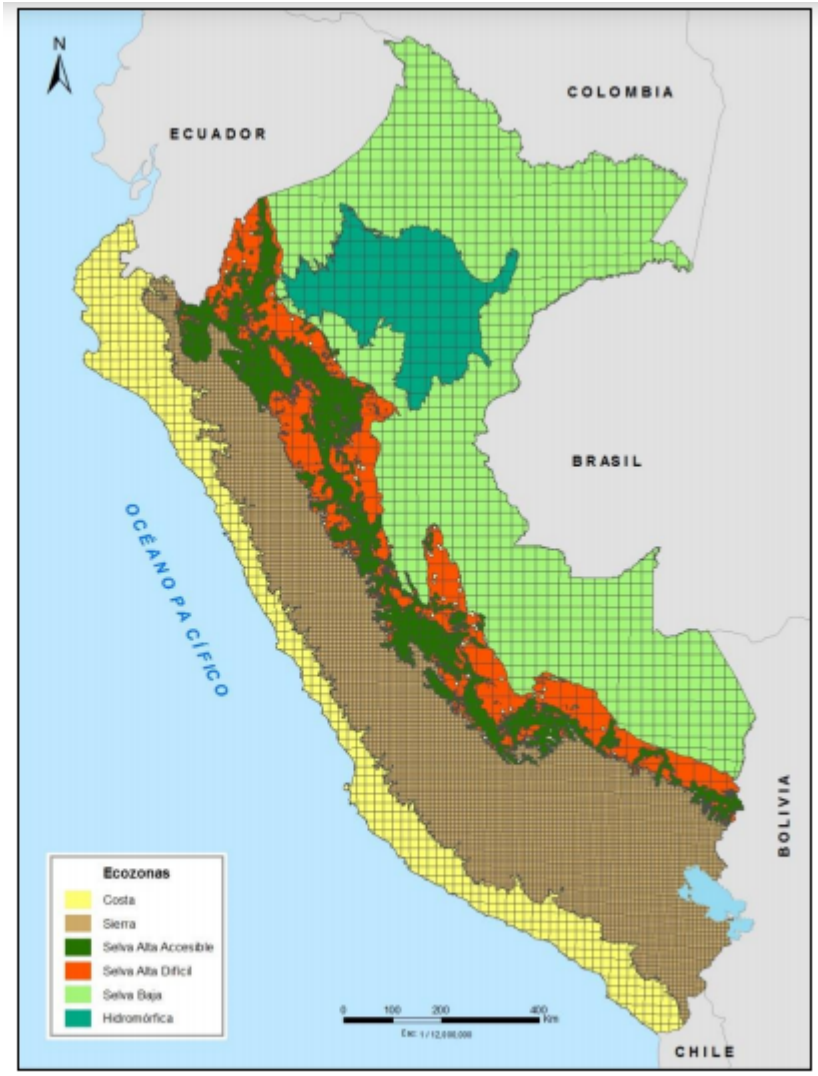
The total sample is 7293 sample units, most of them corresponding to the highlands. This due to the fact that said sub-population registers relict forests and forestry plantations, that are forests of small area and sparse distribution, and therefore in order to capture them in sample, the grid should be more intense (8 km side).

TABLE 58: NUMBER OF SAMPLING UNITS WITHIN THE INFFS TO BE VISITED ON SITE

Ecozone	Total SP according to the sampling design	SP to be programmed (can be visited)
Selva baja	808	804
Hydromorphic	91	88
Accesible selva alta	288	261
Selva alta with difficult accessibility	101	101
Coast	460	112
Highlands	5545	489
Total, population	7293	1855

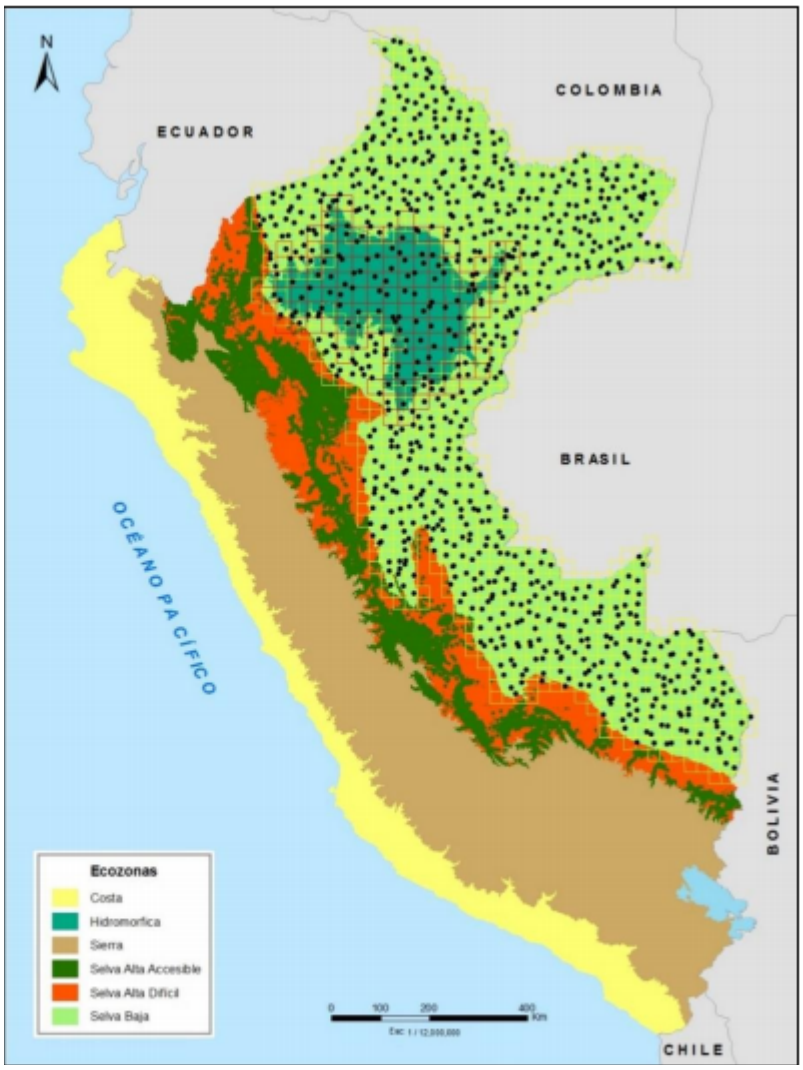
Source: FAO, 2014

Map 19: Squares of INFFS for sampling selection for sub-population



Source: FAO

MAP 20: RANDOM SAMPLE SELECTION IN EACH SQUARE



Source: FAO

For the INFFS, it was decided to carry out a continuous inventory since it makes the institutionalization process, the budget planning, the construction of capacities, the permanence in the learning of the human resources and the mobilization of economic, logistic and human resources easier.

TABLE 59. DESCRIPTION OF THE ON-SITE FORMS FOR THE COLLECTION OF THE INFFS

Form	Description
1	Logbook to access the plot: the main landmarks to access the starting point of the plot are described
2	Location of the plot: Location references to the central point and permanent mark are given. Land use categories are also described.
3	Current land use of the land:

	Data are registered on the state and land use change and disturbances to the vegetation. Also, the structure and succession of the forest is described.
4	UR1 Measurement of live, standing dead trees and stumps: For sub-plots 1,3,5,7 and 9: dasometric parameters are noted for live, standing trees and stumps with a DBH bigger or equal to 10 cm. The effective area of measurement is graphed in case it is not totally covered by forests. For sub-plots 2, 4, 6, 8 and 10: dasometric parameters are noted for live, standing trees and stumps with a DBH bigger or equal to 30 cm. The effective area of measurement is graphed in case it is not totally covered by forests. For all plots: measurement of live, standing dead trees and stumps: Dasometric parameters and condition of live, standing trees and stumps with a DBH bigger or equal to 10 cm are noted. The effective area of measurement is graphed, in case it is not totally covered by forests.
5	Latizales: Counting per specie of those individuals with a DBH less than 10 cm and height less than 3 m is noted.
6	Brinzales: Counting per species of those individuals with a height between 1 and 3 meters.
7	Members of the brigade Data corresponding to all members that conform the brigade and the different roles they occupied were noted. Contact persons: the corresponding data are noted for all people that were contacted in order to access a plot.
8	Fauna registration: evidence of fauna is registered, associated to the land use category where they are spotted.
9	Slope registry: topography registration of the axis of the plot is noted, to the north and east, in terms of slope per tranche (suggested every 5 m).
10	Checking list for internal control of brigades

Source: SERFOR 2019

TABLE 60. ESTIMATION OF EXPECTED UNCERTAINTY FOR THE DIFFERENT VARIABLES OF THE NATIONAL FORESTRY AND WILDLIFE INVENTORY

Variables	Coast	Highlands	Selva baja	Selva alta accesible	Selva alta of difficult access	Hydromorphic
Tree density/ha*	10.7%	10.7%	3.3%	7.1%	9.6%	10.0%
Basal area/ha*	12.0%	12.0%	3.8%	8.3%	11.6%	12.0%
Volume/ha*	10.9%	10.9%	3.3%	7.3%	10.1%	10.4%
Density of stemwood/ha**	17.7%	17.7%	5.8%	10.5%	17.5%	17.2%
Latizales/ha***	15.6%	15.6%	5.2%	10.5%	14.0%	14.3%
Briznales/ha****	16.9%	16.9%	6.0%	12.1%	18.1%	18.4%

* Trees ≥ 10 cm DBH (coast and highlands), ≥ 30 cm DBH (Selva Baja, SA accessible, SA difficult and hydromorphic)

**Stemwood 5 □DBH□10 cm DBH (coast and highlands), 10□DBH□30 cm (Selva Baja, SA accessible, SA difficult and hydromorphic)

***Latizales □5cm diameter 30 cm from the ground, 1-□3 m total height (coast and highlands), □3 m total height (Selva Baja, SA accessible, SA difficult and hydromorphic)

**** Briznales 0.3 - 1m of total height (coast and highlands), 1-3 m total height (Selva Baja, SA accessible, SA difficult and hydromorphic)

Source: Barrena et at (2013)

The National Forest and Wildlife Inventory (INFFS) has the objective to improve the ecologic, social and economic sustainability of forests and its resources and to increase the benefits for rural livelihoods and its role in the mitigation and adaptation of the climate change in Peru.

The GIS team support the planning and design of INFFS. One of the activities was the preparation of ecozones map, input of the tool, developed jointly with the US Forest Service.

The methodology used to elaborate the ecozones map includes GIS tools, combining the following inputs and software.

- Inputs
  - Peru Natural Regions Map
  - Physiography map
  - Vegetal cover map
  - Pastaza River peatlands map
  - Accessibility and displacement map
- Computational programs
  - ArcView 3.3
  - ArcGIS 9.3
  - ArcGIS 10

The criteria used to elaborate the map were:

- Physiography
- Floristic
- Physiognomy
- Carbon content
- Accessibility

The conceptual framework for ecozones map preparation was based on 2 cartography models: ecozones map and accessibility map. The accessibility map was done for the Selva Alta ecozone. A proximity (buffer) analysis to the road and hydrographic networks and overlap those webs with the physiographic units and classify the land in accessibility classes. The ecozone map based on the cartographic model was built using populations with certain level of homogeneity in physiography, vegetal cover, natural regions, RAMSAR wetlands sites and accessibility. Six ecozones were obtained: Coast, Andes, Accessible High Rainforest, Inaccessible High Rainforest, Low Rainforest and Hydromorphic Zone. Each ecozone is described.

SOURCE: Memoria Descriptiva del Mapa de Ecozonas, Inventario Nacional Forestal y de Fauna Silvestre (INFFS)-Perú. Available in https://sinia.minam.gob.pe/documentos/memoria-descriptiva-mapa-ecozonas-inventario-nacional-forestal-fauna

The Selva Baja ecozone is the most extended of all ecozones in Peru with 47 142 813 ha) representing around 36.68% of the country. It is located in large areas of Loreto, Ucayali and Madre de Dios, from north to south of eastern part of the country but includes some areas of San Martin, Huanuco and Cusco too. The range of altitude goes from 100 masl to 500 masl. 90% of Madre de Dios, including the Project Area, the Leakage Belt and the Reference Region, is Selva Baja. Soils and climate are similar, sub-moist, with 98% of slopes lower than 15%.

3.1.4 Baseline Scenario

The REDD+ project is located in Madre de Dios Region, which is one of the Amazonian Regions with the highest deforestation rate growth, growing exponentially since 2009, when the paving of the Interoceanic Highway was completed.

Thanks to this, the cost of transportation of products reduced dramatically and the time to go from Puerto Maldonado (Madre de Dios) to Cusco declined from 3 days to 14 hours. Thanks to this and with the rise of gold price, migration to Madre de Dios from highlands increased drastically and the migrants, mainly dedicated to agriculture in their towns of origin, searched for lands to settle and do the same activities as they did traditionally.

Migrants do not have knowledge or experience for harvesting, processing, storing and trading forest products. For these reasons, and taking advantage of the weak governance, migrants search or obtain illegally from land traffickers, recently cleared forestlands for live and produce.

The following chart shows the increase of deforestation in Madre de Dios, which multiply four times in the current century as was presented in chart 1.

Based on that, the most likely scenario is an increase in deforested areas in the baseline scenario. To estimate the projected rate, it is necessary to define an appropriate area with similar characteristics in terms of political, administrative, social, and geophysical and land tenure aspects.

According to section 8.1.1.2 of the methodology, the reference region must have the following characteristics:

- A minimum size of 250,000 ha, excluding the project area and leakage belt
- Boundaries may be a combination of natural, geopolitical, satellite footprint factors. If possible, coincide with administrative or jurisdictional boundaries.
- Excluding protected and other areas with effective restriction access; planned deforestation; and naturally deforested areas
- Minimum of 15% of forest cover at the beginning of crediting period.
- Similar drivers of deforestation with the ones predominant on project area
- Similar proportion (± 10%) of forest types; elevation (in groups of 500 meters); slope (at 5%)
- Similarity in land tenure classes

- The same administrative jurisdiction
- The same degree of urbanization

The analysis has been done to each one of these criteria and the RR selected meets all these criteria as will be demonstrated.

Administrative Jurisdiction

FORESTAL OTORONGO forest timber concessions are located in Tahuamanu Province, mostly in Iberia and Tahuamanu districts.

For this reason, the reference region is focused on those districts and has been built including the whole remaining area of Iberia district (as the focus from deforestation comes from that district) while the difference is covered by part of Tahuamanu district. It must be remembered that the reference region must be at least 250,000 hectares.

FORESTAL OTORONGO forest timber concessions are located in Tahuamanu Province, mostly in Iberia and Tahuamanu districts:

TABLE 61: PROJECT AREA LOCATION, BY DISTRICTS (IN %)

District	Area	%
Iberia	75,050	41%
Las Piedras	479	0%
Tahuamanu	93,146	51%
Iñapari	14,341	8%
	183,016	

While, the reference region is distributed as follows:

TABLE 62: REFERENCE REGION LOCATION, BY DISTRICTS (IN %)

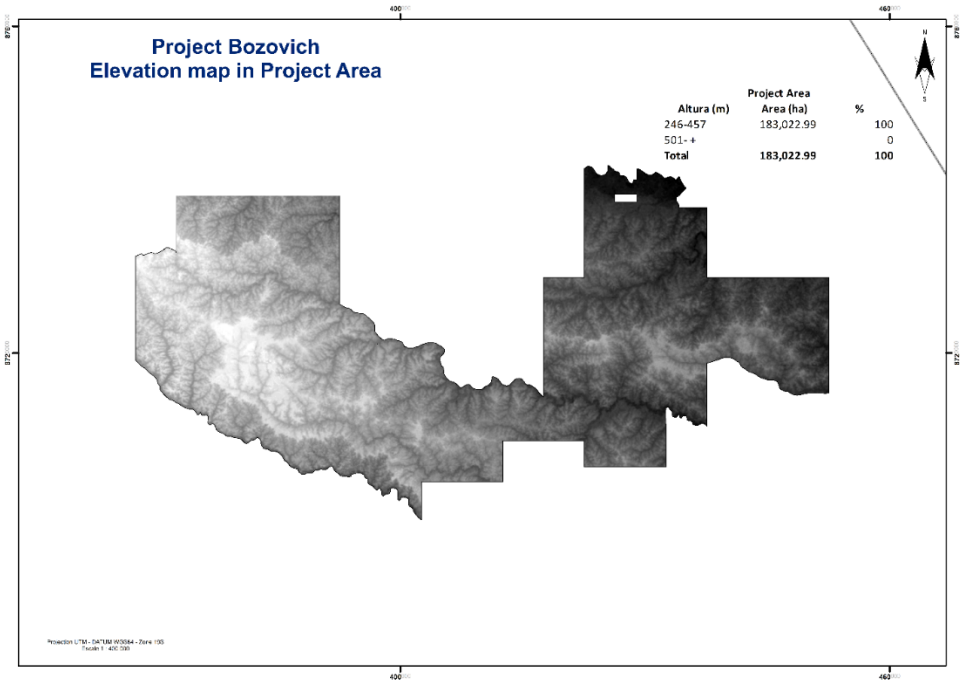
District	Area	%
Iberia	105,604.22	20.44%
Tahuamanu	252,364.63	48.86%
Iñapari	158,489.87	30.68%
Las Piedras	82.23	0.02%
	516,554.22	100%

Physiography similarities

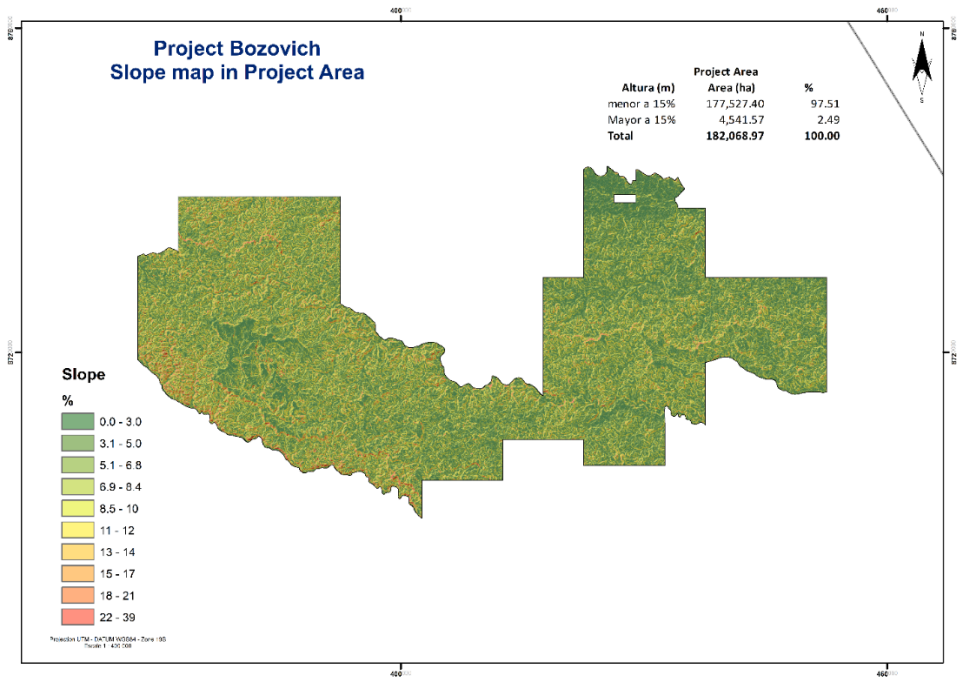
In addition, RR and PA are similar in elevation and slope, as can be seen in following maps:

100% of PA and RR are below 500 meters above sea level (masl), while more than 97.5% of PA and RR have a slope of less than 15%.

MAP 21: ELEVATION MAP IN PROJECT AREA



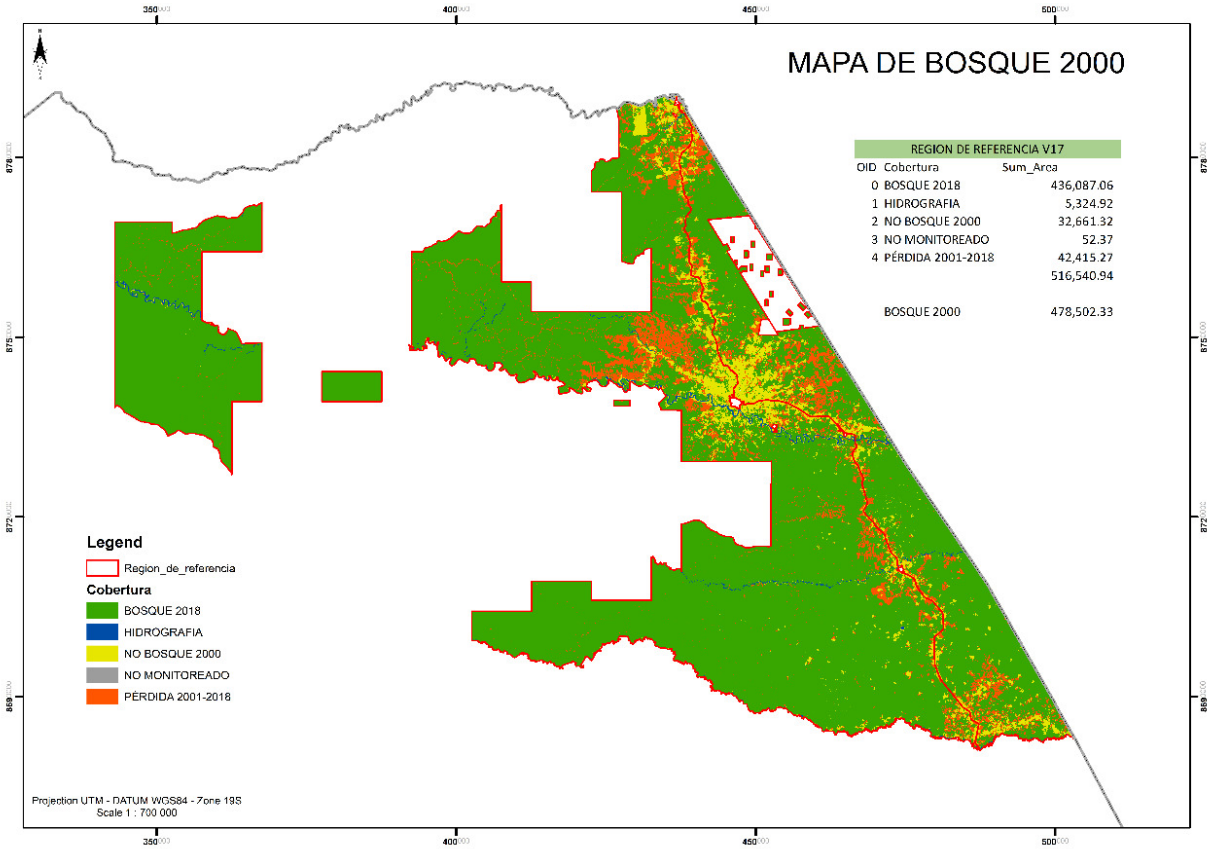
MAP 22: SLOPE MAP IN PROJECT AREA



According to official data, the only stratum present in the PA and RR is “selva baja” so the similarity is complete on this regard too.

Finally, in 2018, 80% of the reference region area is forest covered, largely higher than the minimum required by the methodology, which is defined in 15%.

MAP 23: FOREST COVER IN REFERENCE REGION



Below, you will find a comparative analysis of the reference region and the project area, according to requirements of the methodology:

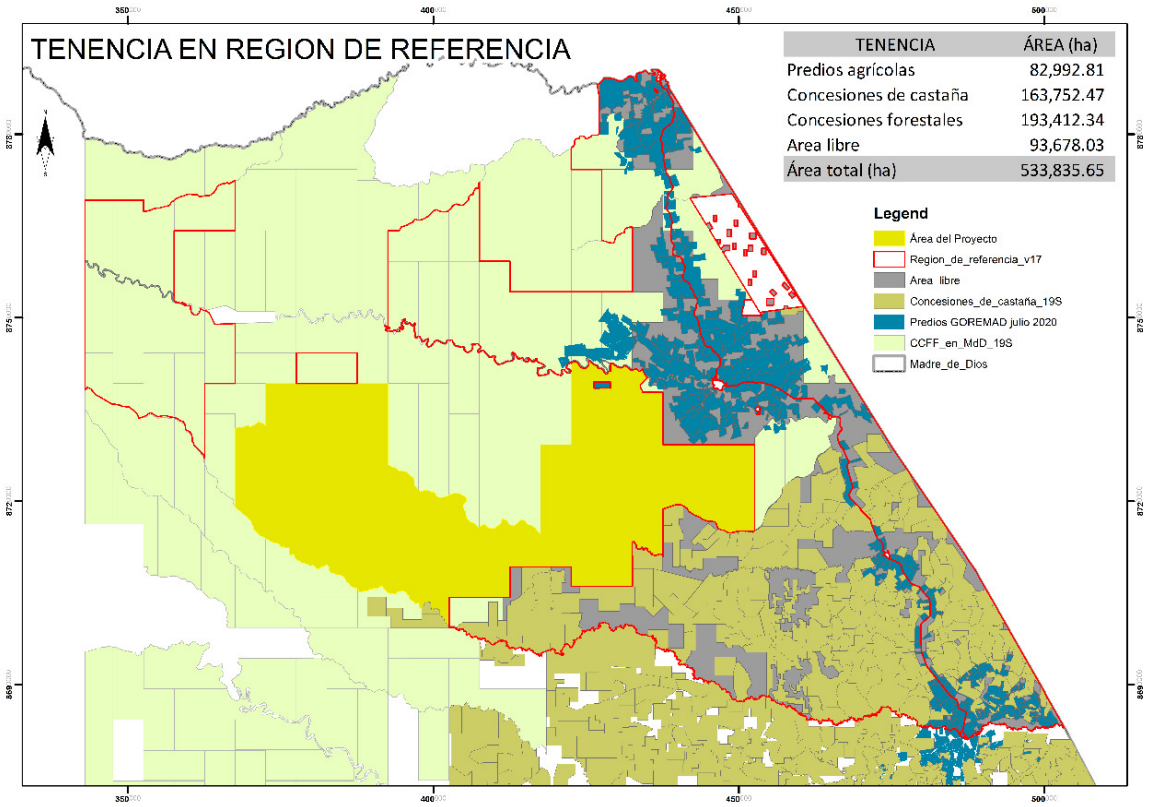
TABLE 63: COMPARISON BETWEEN PROJECT AREA AND REFERENCE REGION

Category	Reference Region	Project Area
Drivers of deforestation	The pattern of deforestation in Madre de Dios is pushed by two agents: in the south, by illegal mining while in the rest of the department, by agrarian expansion. In the case of the reference region, located in the northeast part of Madre de Dios, the main drivers are related to expansion of agrarian frontier.	In the project area, as described in Section 4, there are four communities settled in the surrounding area that are the main threats to the project area, mainly dedicated to corn production and other subsistence crops and cattle ranching.

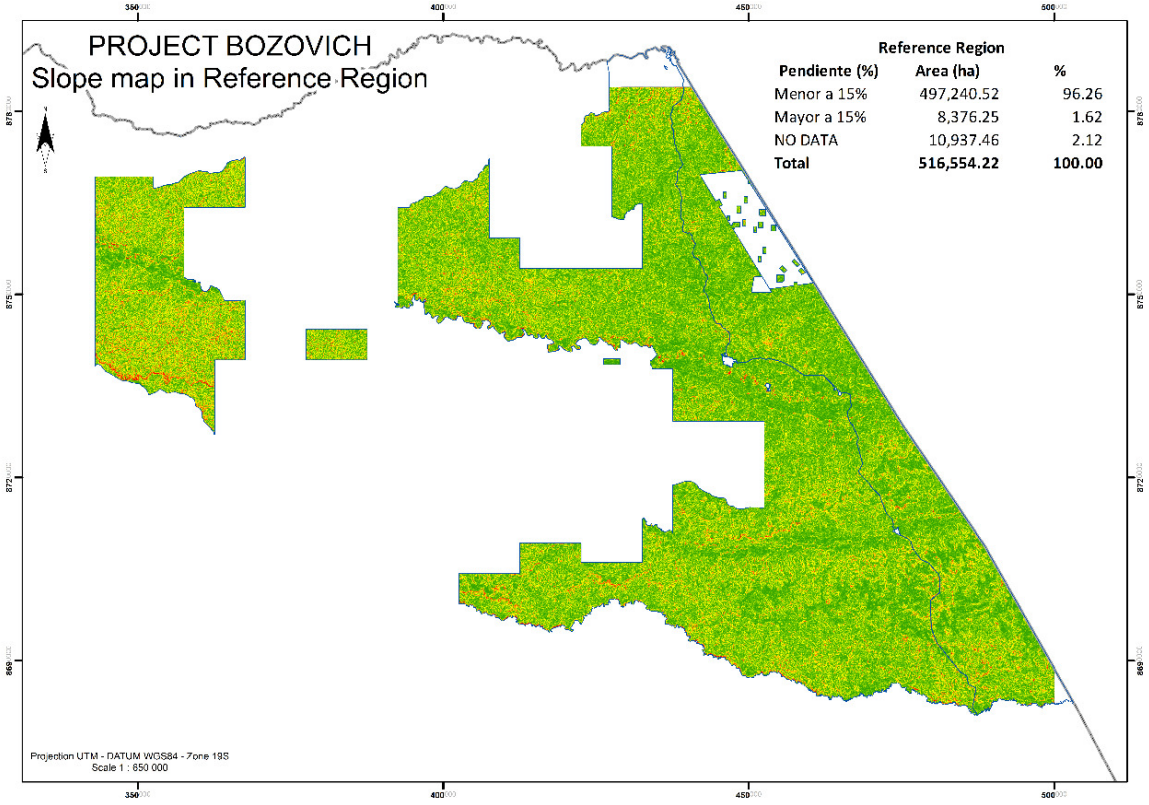
	With the paving of the Interoceanic Highway, the phenomenon has accelerated dramatically. The historical analysis of land use change, available in GEOBOSQUES webpage, confirms that conversion to croplands (25%) and pastures (60%) are the main patterns of land use change in the province of Tahuamanu, which contains most of the reference region. Meanwhile, the Tambopata province has a different pattern of conversion, where pastures represent 29%, mining 28% and agriculture 25%. This difference in patterns re-enforces the concept that most of the reference region should be located in the Tahuamanu province.	For this reason, the main drivers in both cases are very similar as are also associated to the expansion of the agrarian frontier.
Distribution of native forest types	Based on official sources, the forest national inventory stratifies the Peruvian Amazon Rainforest in four ecozones. The reference region, as most of Madre de Dios department, is under the "Selva Baja" ecozone. Specifically, this ecozone covers 100% of total forest area within the Reference Region.	Similarly to the reference region, 100% of the project area is located in the Selva Baja ecozone.
Elevation	98.56% of reference region has an elevation lower than 500 meters above sea level. The difference has NO DATA.	100% of the project area has an elevation lower than 500 meters above sea level
Slope	96.26% of the reference region has a slope lower than 15%. Madre de Dios, as most of the Selva Baja ecozone is characterized by plain terrains	97.5% of the project area has a slope lower than 15%. Most of the area are plain terrains
Land tenure status	The reference region is composed by a mix of different land tenures. Forest concessions represent 69% of total area of the RR, while agrarian titled plots represent 16%. Areas without data (probably, a share of these are being untitled plots) are 18%. As seen, there is a 3% of overlapping rights. Culturally, most of the families are migrants or descendants of migrants. The pattern of migration is that recent newcomers do not settle in new areas (which is difficult) but they are relatives to old migrants and settle in the areas of expansion of the communities where their families live.	The project area is composed by two forest concessions. As definition, the project area must be fully forest covered, not allowed to be granted as private property so, there is no option than the project area included agrarian lands.
Policies and regulations	The reference region is located in the province of Tahuamanu. The southern boundary corresponds to a natural division, which is River Las Piedras.	The project area is located 99.7% in Tahuamanu Province, bordering in the south frontier with Tambopata Province. Only 0.3% of the project area is located within the Tambopata Province. Being located in the same province and districts and with the scope of the some forest

		authority, the policies and regulations are similar.
Degree of urbanization	The reference region proposed has intentionally exclude towns and the highway since, according to the methodology, no planned deforestation is allowed to be part of the reference region. It is controversial to state that urbanization is planned in the Peruvian Amazon, as most of the towns are invasion to forest areas, lately legalized by local authorities, but for conservative purposes, those areas have been excluded.	As a forest concession, settlements are forbidden to establish within the project area. If this would happen, the concession would have to be re-measured to exclude the deforested area. In conclusion, both the reference region and the project area have zero degree of urbanization.

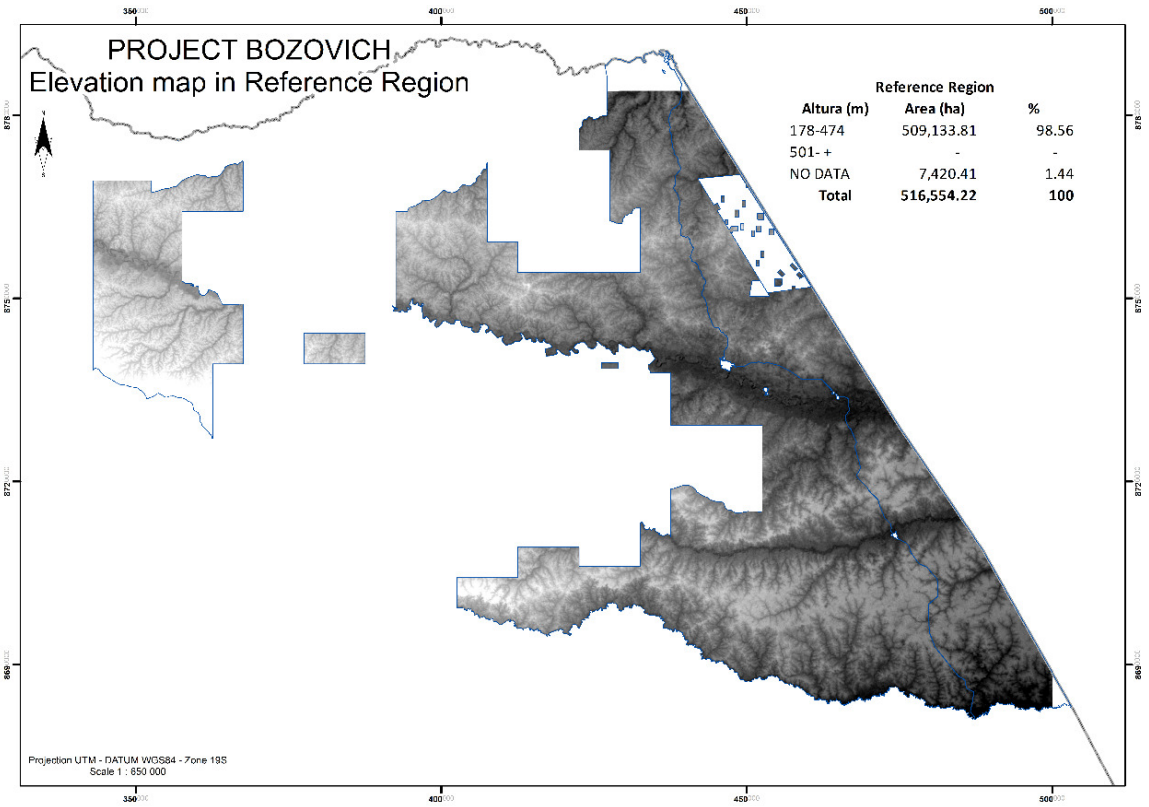
MAP 24: LAND TENURE IN PROJECT ZONE



MAP 25: SLOPE MAP IN REFERENCE REGION



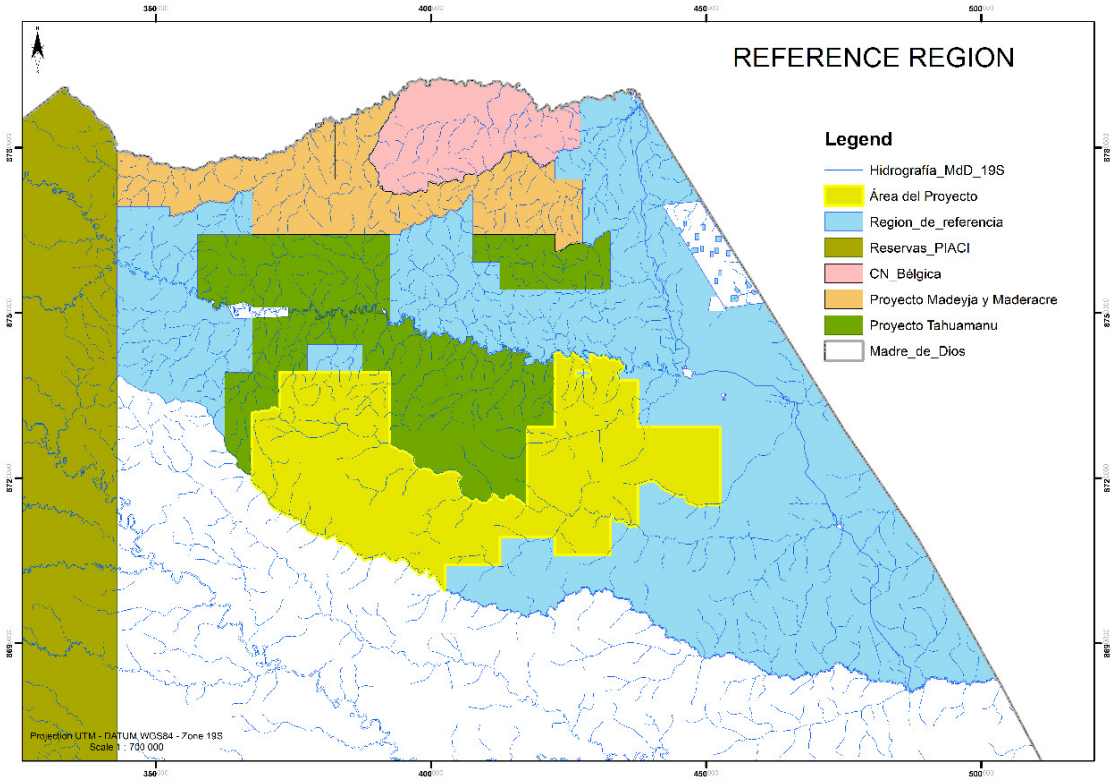
MAP 26: ELEVATION MAP IN REFERENCE REGION



Exclusion of restricted areas

After having analyzed, those characteristics, the proposed reference region is the following:

MAP 27: LAND TENURE IN REFERENCE REGION



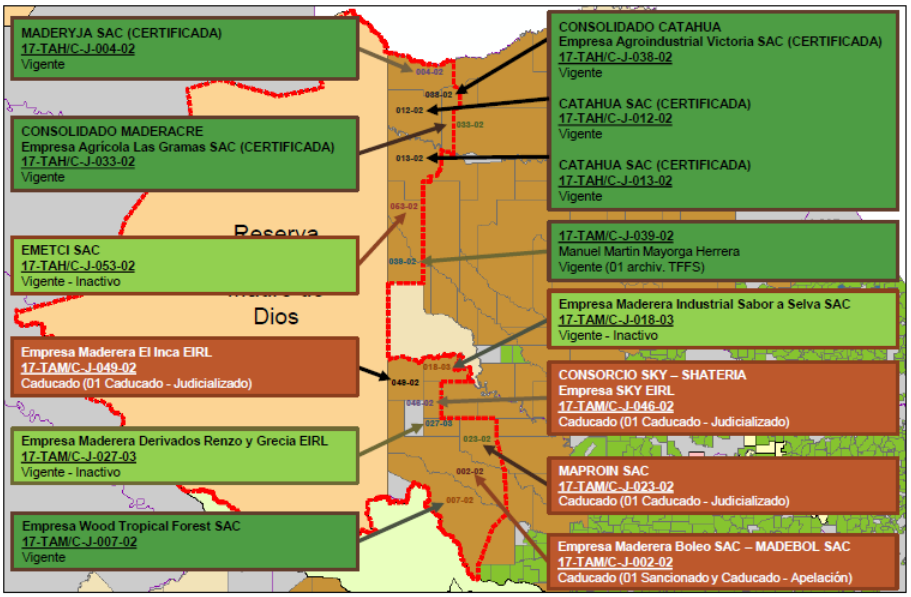
The new reference region proposed borders, wherever is possible, the project area at the east, south north and west. At the north (and west) another forest concession, owned by Maderacre Group is excluded as it is assumed that the same successful governance registered in their REDD+ project is achieved in the future REDD project area. But, beyond that area, to the west, the reference region continues, being limited at the north by the international boundaries with Brazil, at the south by River Las Piedras, at the west by the PIACI territory (the land for uncontacted indigenous groups) and at the East by the international boundary with Brazil.

In the north, excluded areas only include forest concessions under management of Maderacre and Maderyja, because they have demonstrated a total and effective conservation achievement and control of their area through their forest management. Belgica Indigenous Community, supported by the Madre de Dios Amazon REDD Project has also been excluded. The indigenous community carries out the monitoring and patrolling of its area jointly with the Madre de Dios Amazon REDD Project (by land and by the river) and also shares a control post at the entrance to the community lands to be able to control each person who enters.

In addition, a small white area in the north, not included in the reference region, the area was originally granted to and managed by a very well international acknowledged NGO, ACCA (in English, ACA, Amazon

Conservation Association (https://www.amazonconservation.org/), who transferred it to an educational entity, IST Iberia (Technological Superior Institute). Actually, as the area is neighboring the forest concessions of Maderacre Group, who owns more than 225 thousands of hectares of FSC certified forests, this group has included the area in their periodic patrolling routes as protecting it helps to reduce the presence of illegal loggers and even invaders as it's already occurring in other forest concessions. For these reasons, the area should be considered as part of the protected forest of Maderacre and excluded as the rest of the area under their management.

MAP 28: POTENTIAL EXPANSION OF PIACI TERRITORY



For this reason, we have not included that area in the Reference Region.

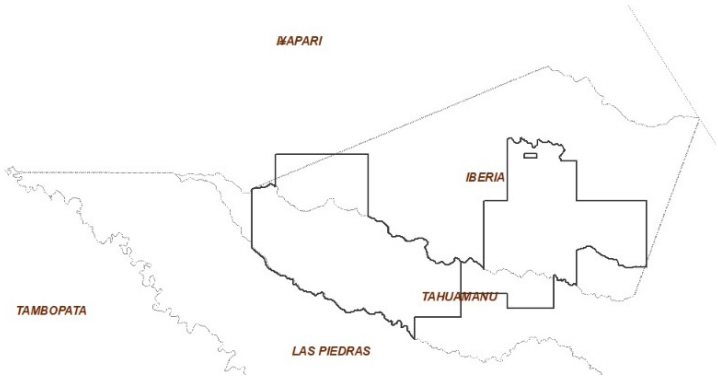
All other forest concessions in the north and south have been included. The southern areas include also Brazil nut concessions.

The conservation concession in the north-eastern part of the reference region (very close to the Interoceanic Highway) and two minor ecotourism concession have been excluded as requested by the methodology.

We consider that this Reference Region is the area that is the most accurate according to the requirements of the methodology for reference region and leakage belt and reflects in the best way the future trajectory of land use within the project area.

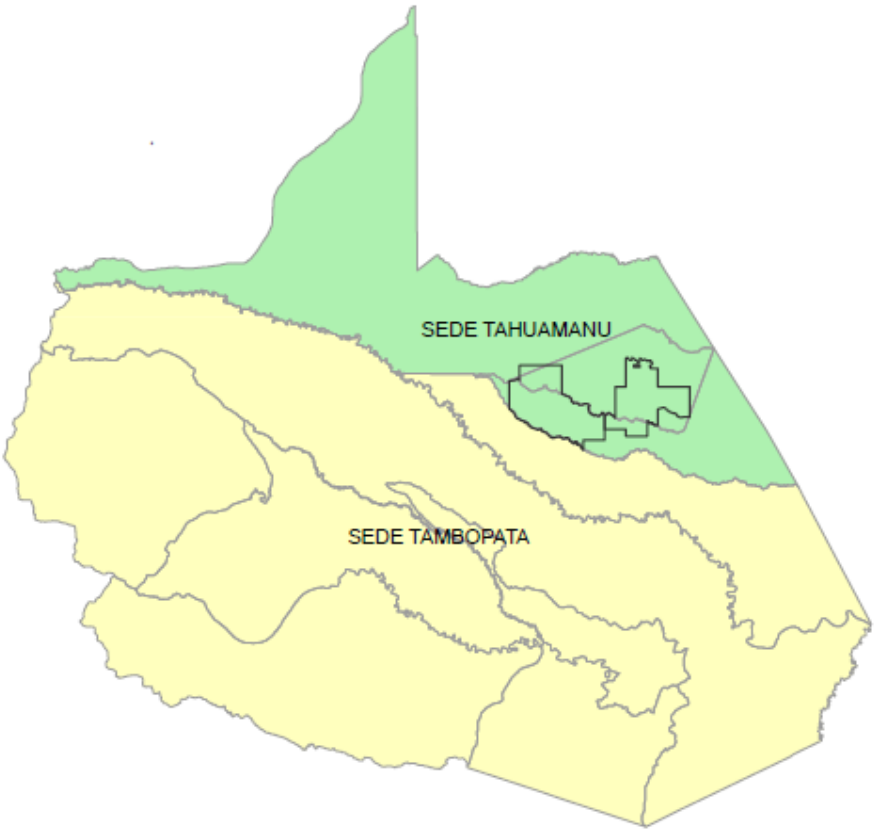
The proposed reference region balances areas with low deforestation rate (0.05%) and areas with high deforestation rate (0.79%) in percentages that are very similar to the two concessions that compose the project area: Chullachaqui, at the west, as the area that will face a lower degree of pressure of deforestation, and Otorongo, seeing already very close to its border the expansion of Arca Pacahuara.

MAP 29: POLITICAL ADMINISTRATIVE DIVISION BY DISTRICTS



But, second, and most important, and decisive for our decision to exclude is that Forest Authority is divided by different Technical Forest and Wildlife Authorities. In some cases, there may be huge differences as we will analyze below. As can be seen in the following map, the forest promotion and control is under two different authorities: The Tahuamanu Office (that governs the group concessions) and the Tambopata Office (that governs the area at the South of River Manuripe).

MAP 30: GEOGRAPHICAL SCOPE OF FOREST OFFICES



- The main difference between both offices are:
  - Tahuamanu manages more forest concessions than Tambopata and, at the same time, there is a larger percentage of the forest concessions in Tahuamanu are still operating while Tambopata has a larger percentage of concessions with a caducity process.

- Tahuamanu has the highest area of certified forests in Madre de Dios and in Peru
- This may be explained by what has been mentioned before. Tambopata deals against more dangerous threats than Tahuamanu. Corruption networks involving public servants, murder of environmental activists by illegal miners, land trafficking among others set up a very different landscape than in Tahuamanu. In Tahuamanu, Forest Certification prevails in this province, setting up a lower level of threat than in similar areas of Tambopata. For all these reasons, excluding forest areas located in Tambopata province is conservativeness as Tahuamanu has a significant higher forest governance than Tambopata.

After defining the Reference Region, we have estimated, from the official source (http://geobosques.minam.gob.pe/geobosque/view/perdida.phphttp://geobosques.minam.gob.pe/geobosque/view/perdida.php), the annual forest loss in the area of the Reference Region since 2008.

Note: Estimations of calculations in this section are preliminary and subject to confirmation during first verification stage.

As recommended by the most prestigious standards, the historical reference period must be at least the 10 most recent years so the projection is based on the period 2008-2017. The annual forest loss in the area of the Reference Region since 2008. Data is shown below:

TABLE 64: FOREST LOSS IN REFERENCE REGION

Year	2,008	2,009	2,010	2,011	2,012	2,013	2,014	2,015	2,016	2,017
Forest loss in RR (ha)	1,974	705	1,187	1,317	852	1,515	2,316	2,607	3,065	4,104

A statistical consultancy was hired to choose the most accurate beta regression feasible with the available most recent data. Report may be found in Annex 12. Then, with the results obtained, we extrapolate the data to the project area by multiplying by a factor obtained by dividing the (project area / reference region area). Where project area is 183,015.29 ha while reference region area is 516,554, so the fraction is 0.36.

To extrapolate from hectares to tons of CO2e, we also have used the official information about emission factor; the eco-zones of Ministry of Environment. The whole project area and reference region is located in the Eco-zone “Selva Baja”, which have an average stock of CO2e of 576.25 tCO2e/ha. This can be verified in the official FREL submission of Peru to UNFCCC[24].

TABLE 65: CARBON CONTENT IN AGB, BG AND AGD

	t C/ha	tCO2e/ha
Aboveground biomass	138.84	509.08
Belowground biomass	1.707	6.259
TOTAL	140.547	515.339

SOURCE: NATIONAL FOREST AND WILDLIFE INVENTORY (2019)

24 https://redd.unfccc.int/files/2015_submission_frel_peru_es.pdfhttps://redd.unfccc.int/files/2015_submission_frel_peru_es.pdf

By using the chosen equation (67.681 x^2 – 496.84 x + 1957), where x = year, the next step was projecting to the first 10-years crediting period years (2018-2027).

TABLE 66: PROJECTED FOREST LOSS FOR REFERENCE REGION

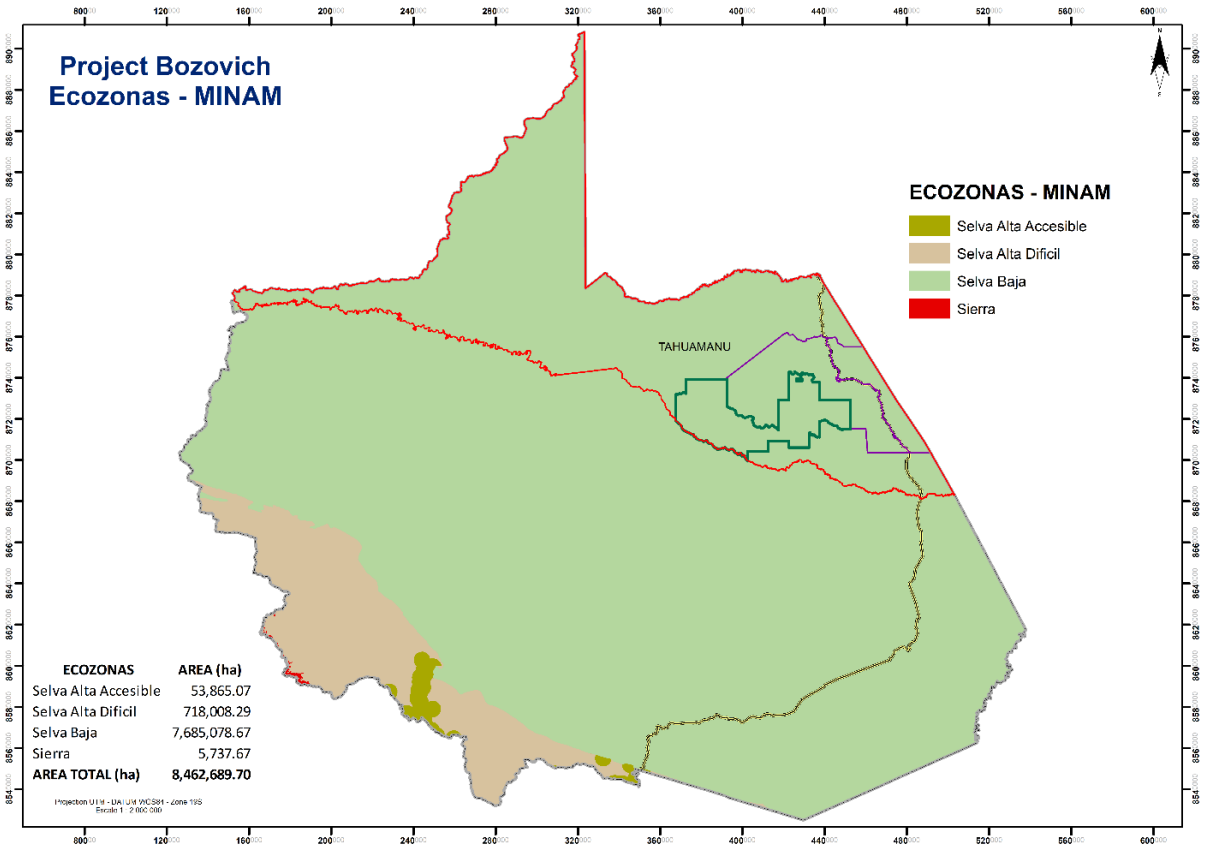
		2018 (year 11)	2019 (year 12)	2020 (year 13)
Reference Region	Hectares	6,260.53	6,987.42	7,737.18
	tCO2e	1,607,949.14	1,794,642.94	1,987,208.90

Then, with the results obtained, we extrapolate the data to the project area by multiplying by a factor obtained by dividing the (project area / reference region area).

CHART 7: FORMULA TO DETERMINE EMISSIONS IN PROJECT AREA

$$\text{Emissions in Project Area} = \text{Emissions in Reference Region} \times \frac{\text{Project Area}}{\text{Reference Region Area}}$$

MAP 31: FOREST ZONE IN PROJECT AREA AND REFERENCE REGION



To extrapolate from hectares to tons of CO2e, we also have used the official information about emission factor; the eco-zones of Ministry of Environment. The whole project area and reference region is located in

the Eco-zone "Selva Baja", which have an average stock of CO2e of 576.25 tCO2e/ha. This can be verified in the official FREL submission of Peru to UNFCCC[25].

TABLE 67: PROJECTED FOREST LOSS FOR PROJECT AREA

		2018 (year 11)	2019 (year 12)	2020 (year 13)
Project Area	Hectares	2,218.11	2,475.65	2741.283834
	tCO2e	-569696.7711	-635842.4313	-704068.5985

3.1.5 Additionality

To develop this section, we have applied the "tool for the demonstration and assessment of additionality in VCS agriculture, forestry and other land use (AFOLU) project activities" (VT 0001). Version 3.0 from February 2012, Sectoral Scope 14.

STEP 1: IDENTIFICATION OF ALTERNATIVE LAND USE SCENARIO

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

There are two alternative land use scenarios that may occur in the project area in the without-project or business as usual scenario.

One option is that the area may continue being sustainable managed by FORESTAL OTORONGO until the end of its concession contract. This is in conformance with legal framework.

The other option and the most credible land use in the without project scenario is the expansion of agrarian frontier from rural producers living in the surrounding settlements. This assumption is based on the empirical evidence registered by forest cover monitoring module IMMCB), in charge of PNCB-MINAM.

As can be seen in following table, deforestation in other forest concessions shows an increasing deforestation rate in a land tenure class that is the same category that the project area: a timber forest concession.

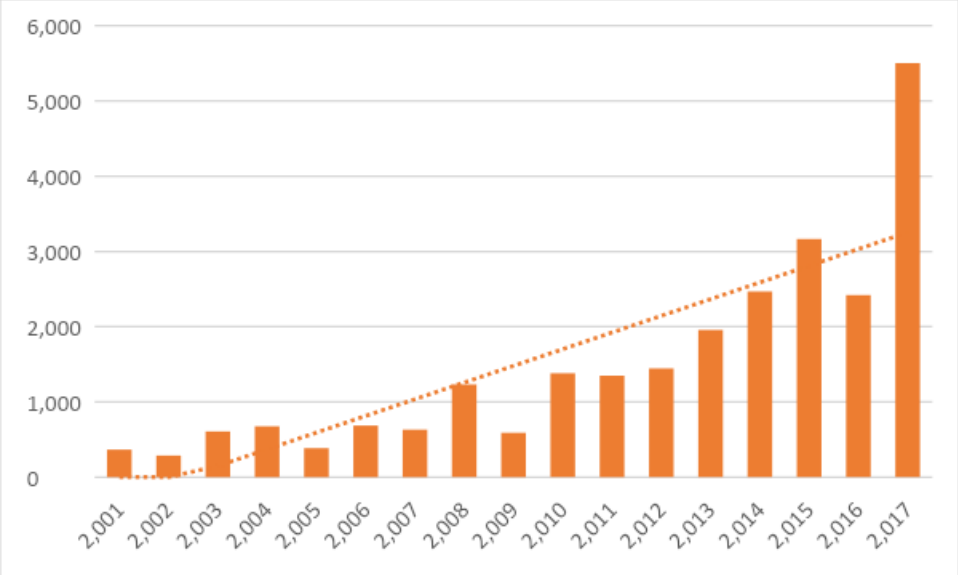
TABLE 68: DEFORESTATION IN MADRE DE DIOS FOREST CONCESSIONS (IN HA/YEAR)

2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
366	287	607	676	385	686	631	1,233	590	1,381	1,348	1,444	1,958	2,469	3,164	2,418	5,505

The data shows an exponential growth rate of deforestation so it is likely to assume that the project area will face a similar situation in the absence of the implementation of the project with the carbon incomes.

25 https://redd.unfccc.int/files/2015_submission_frel_peru_es.pdfhttps://redd.unfccc.int/files/2015_submission_frel_peru_es.pdf

CHART 8: DEFORESTATION IN MADRE DE DIOS FOREST CONCESSIONS (IN HA/YEAR)



More details on the threat that the project faces may be found in Community Section.

Reforestation is not a current practice in Peru nor in Madre de Dios region. According to official statistics from SERFOR, 0 hectares were reforested between 2010 to 2017 in Madre de Dios[26]. Many reasons explain this situation but the main factor is referred to the inexistence of financial products appropriated to the needs and time window required for this long-term investment. Other factor is that land tenure in Peruvian Amazon is characterized by small-scale, untitled agrarian plots. Reforestation needs scale investments.

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

Even though the land use change in areas whose main capacity is the forest production is forbidden, the empirical evidence shows that current traditional practices prevails and it is being more and more intensive on time. Many forest concessions in Madre de Dios are not feasible anymore because they were forced to reduce their forest production area because of the deforestation and illegal logging. Data presented in table 68 supports this assumption.

According to official data of forest loss, there are 91 contracts of forest concessions (the similar type of land tenure than project proponent) in Madre de Dios, and incredibly in all of them (100%) have suffered illegal deforestation within their granted area at some moment between 2001 and 2017, with 10% with more 1,000 hectares deforested and 30% with more than 100 hectares lost. For this reason, we considered that this illegal activity is prevalent under the definition used by the methodology.

26 https://sinia.minam.gob.pe/modsinia/index.php?accion=verIndicador&idElementoInformacion=1408&idformula=133&idTipoElemento=1&idTipoFuente=&verPor=tema&idfuenteinformacion=

Sub-step 1c. Selection of the baseline scenario

The baseline scenario is a growing deforestation rate caused by an expansion of agrarian frontier.

STEP 2: INVESTMENT ANALYSIS

Annex 2 shows the cash flow of the operation in two scenarios: with REDD+ project (incomes and activities) and without REDD+ project. The results show that with the REDD+ project, the Net Present Value (NPV) increases from US$ 4.5 million to US$ 5,6 million, which is an increment of 22%.

The financial analysis has been conservative as it is assuming incomes from carbon sales of US$ 2 million in the first year and US$ 840 thousand, the next six years. Last three years, sales from first baseline period are not expected. This is because the first year, the verification process will include three vintages (2018-2020). It must be remembered that JAGUAR PROJECT has a partner as GREENOXX, who has a proven history of marketing success and presence in carbon markets. Price used is obtained from average sales of GREENOXX from other Peruvian REDD projects. Volumes are obtained from the current PD.

The analysis has included ten years. Regarding timber sales, the assumptions are based on the many years of experience of FORESTAL OTORONGO. Price has been supported with sales contracts for the timber with the less level of transformation, which is round wood, in order to be conservative. Timber volume has been obtained from the project proponent harvest balances (Balances de Extracción) approved by forest authorities.

Regarding costs associated to timber extraction, they include cutting, dragging, transportation, road maintenance, machinery and equipment maintenance, forest planning. Also, forest certification, legal fees, monitoring, forest protection, post-harvest management are included. These costs have been obtained from historical records in our accounting system, officially reported to the National Tax Office. Regarding labor costs, these have been also collected from the official information provided to the Ministry of Labor.

They are also based on large experience of decades dedicated to this productive activity while costs associated to carbon business are also based carbon credits generation (design, certification, registry, issuance and other fee). Financing the implementation of REDD+ project activities (patrolling and monitoring, productive project promotion, training, research, delimitation, among others) and community and biodiversity monitoring.

Regarding the discount rate used to calculate the NPV, the cash flow has worked with a discount rate of 10%. This value has been obtained from an independent research, developed by “EQUBO Financial Advisor”, who valuated the companies of Bozovich Group and which recommended an interval between 9 and 13% as an adequate value for the discount rate. This is a sensitive information, so it will be shared with audit team directly.

In the financial analysis, attached as Cash Flow, the NPV reduces from US$ 5.565.005 (in the project scenario) to US$ 4.549.319 in the without project-scenario. This implies that without the incomes from carbon sales, FORESTAL OTORONGO will not be able to fund and implement the project activities that are key to reduce the deforestation rate that is expected according to baseline projections within project area. According to the same cash flow, the estimated required budget for the same analysis period for project activities is US$3.821.571. In the case that those activities would have implemented with FORESTAL OTORONGO funds (but without carbon incomes), the NPV would have reduced to US$ 3.845.538, which has a net NPV value per hectare of US$21.61, lower than the best opportunity cost.

Therefore, the company, without the incomes from carbon sales, will not implement the activities needed to prevent growing deforestation rate with the subsequent impact on the loss of forest area at the rates established in the baseline scenario registering the progressive and proportional reduction of its harvestable area and timber incomes. So, the NPV in the without project scenario will continue reducing through the years as is observed in surrounding forest concessions.

Sub-step 2d:

TABLE 69: SENSITIVITY ANALYSIS OF CASH FLOW

NPV	Total	Per ha
a. With carbon incomes	5,565,005	31.28
b. Without project scenario	4,549,319	25.57
c. Without carbon incomes	3,845,538	21.61

Sensitivity Analysis	Base scenario	-10%	-20%
1. Carbon price	2.00	1.80	1.60
NPV per ha – a	31.28	29.19	27.11
NPV per ha – b	25.57	25.57	25.57
NPV per ha – c	21.61	21.61	21.61
Volume sold (in %)	100%	90%	80%
NPV per ha – a	31.28	29.19	27.11
NPV per ha – b	25.57	25.57	25.57
NPV per ha – c	21.61	21.61	21.61
Annual timber incomes	2,562,666	2,306,399	2,050,133
NPV per ha – a	31.28	23.23	15.19
NPV per ha – b	25.57	17.52	9.48
NPV per ha – c	21.61	13.57	5.52

A sensitivity analysis has been done considering three variables: carbon price, percentage of volume sold and timber incomes. The first two of them related to carbon business while the third one related to the core business of the project proponent.

Results show that REDD project is very sensitive to timber incomes and, in that scenario, carbon incomes may make the difference in terms of the possibility to continue operating or not. As shown, carbon incomes may vary its share in total NPV from 22% in the base scenario to 60% in the scenario where annual timber incomes reduce in just 20%. For this reason, we conclude that the REDD project is unlikely to be financially attractive and is under a high degree of vulnerability without the incomes from carbon sales. So, the analysis moves to step 4.

STEP 4: COMMON PRACTICE ANALYSIS

No similar practices as the ones proposed by the project proponent as project activities specifically designed to reduce deforestation rate by change the pattern of land use and offering alternative sustainable economic incomes to neighboring rural families. Only other VCS REDD+ projects implement this type of activities successfully but the tool clearly states that this type of initiatives must be excluded in this mapping.

Even though there were granted many timber concessions since 2002, with most of them having reverted or sanctioned (in process of reversion) to State for many reasons:

- Expired by national forest supervision office, OSINFOR, for any violation of legal framework (sale of forest permissions, debt of canon payment, logging of seedling trees or trees outside of forest concession or annual harvest area
- Abandoned by the concessionaire because illegal logging or invasions

There are 91 forest concessions in Madre de Dios. All of them recorded forest loss within their areas. 64% was less than 100 ha. 27%, between 100 to 1000 hectares lost. And 9% with deforestation over than 1000 ha.

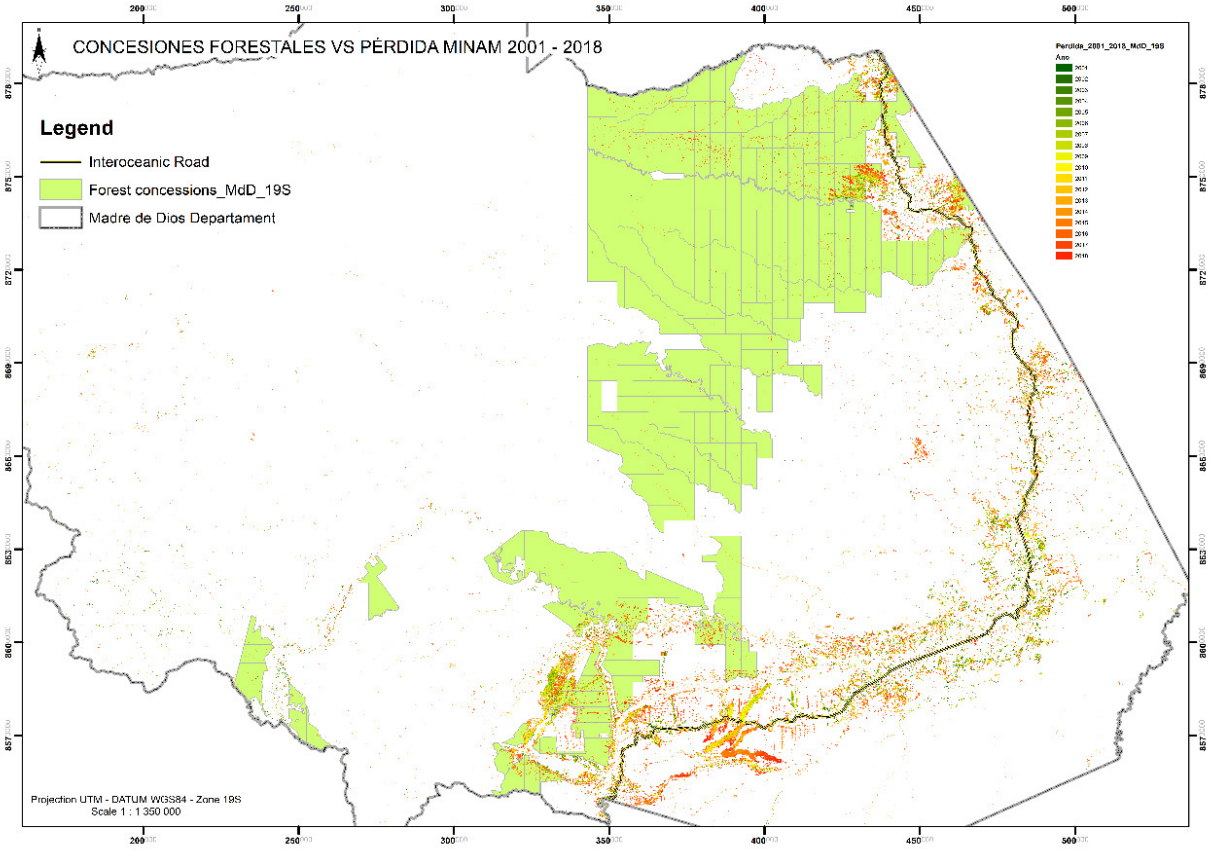
In 2015, according to OSINFOR, 23% had reverted (some of them were in the courts or were appealing administratively). On the red list, mentioned above, for a period going from 2011 to 2019, 16 timber concessions of Madre de Dios appeared. This is very characteristic of the institutional landscape.

Forest management is a good strategy to deal with drivers, but, in the changing situation with increasing pattern of threat, they show clear limitations to face successfully this new context.

Other forest concessions, before having the same destination than those concessions, were transferred to others, creating consolidated concessions, scaling up to a level that makes profitable the operations.

As a consequence, almost all the forest concessions in Madre de Dios have suffered deforestation as may be seen in map.

MAP 32: FOREST LOSS IN TIMBER CONCESSIONS 2001-2018



In annex 15, the list of forest concessions expired and the red list of illegal logging are attached.

For this reason, and following the methodological tool, the project is clearly **additional**.

3.1.6 Methodology Deviations

Deviation No. 1

To determine the additional or extra time that the deforestation agents will be willing to displace themselves to continue doing its activities, the project has opted for not obtaining that information by applying a social assessment but instead of that, has obtained that information by analyzing real historical pattern of those agents in the past, i.e., how far they have deforested in the past and this value is multiplied times 1.5, as indicated by the methodology.

The reason why the information was not collected by asking them directly is that deforestation is illegal. Asking them could be interpreted as an authorization of continue doing their illegal activity and at some point, a way of promoting them or a relax of governance. In any case, project proponent agrees to give these type of signals or messages.

The alternative method (reviewing their historical behavior), is a more realistic approach as it is a proof, not of what they think they would do, but of what they demonstrated that they did.

Deviation No 2

In addition, the methodology requires to build the leakage belt as the area where the potential deforestation will be displaced in the project scenario and they consider that the approach is the maximum willingness to displace their activities from the project area. We maintain that approach as we consider that the leakage is the area where the drivers will have to go if they are not allowed to deforest within project area in the project scenario. Our hypothesis is that the reason why they would deforest the project area is because it is profitable enough to establish there, their productive activities considering the distance cost to closest markets. So, based on that assumption, we assume that the maximum willingness to displace from project area is to areas within the reference region that has a similar distance cost (multiplied by 1.5, as requested by the methodology) to closest markets. This may be considered a slight methodology deviation as the reference of maximum value is not related with the distance to project area but the distance to markets.

Deviation No. 3

As per the VCS standard. section 3.17 (methodology deviations) the only quantification analysis that will be reviewed and validated during this validation process are: 1) delineation of the Reference Region and 2) delineation of the leakage belt. The rest of the quantification analysis requested in the methodology will be deferred until the first verification of the project is carried out. Therefore, all quantification sections that appear completed in the PD are only estimations and will be updated in the first verification.

The present deviation will not negatively impact the conservativeness of the quantification of GHG emission reductions or removals due to the fact that it only defers the quantification of emissions to the first verification. The validation of the ex-ante baseline, project, leakage, and estimated net emission reductions will be validated after the validation, but at the beginning of the verification process, thus prior to the verification of ex-post emissions. This means all these items will be validated, but the timing of that validation will just be deferred to occur at the start of the verification engagement.

Also, the present deviation is only related to monitoring and measuring and does not impact in the project design since both the baseline (project area and reference region) and the leakage belt have been delineated and will not suffer any variation during verification.

The reason for deviation No. 3 is that during a meeting that took place in November 2020, the MINAM (Ministry of Environment of Peru) made an official presentation where they stated REDD Early Initiatives were those that were validated before 31st December 2020. Therefore, the need of the deviation to comply with said request, since by the end of the year, in great part due to the exceptional situation of the pandemic, there was still pending outstanding work related to the ex-ante quantification. All this circumstances, made meeting the 31st December, 2020 deadline not possible.

In that same meeting, various project developers asked what would happen to those REDD Projects that were already being developed but could not be validated before 31st December 2020. The MINAM confirmed (verbally) that those projects would be allowed to be implemented and would be able to issue certificates with their own baselines (up to vintage 2020).

All the same and given the fact that the only written document from MINAM stated the date 31st December 2020 as a deadline for the early initiatives, the objective is to be sure the project complies, without any type of doubt, with everything requested by the Government and finalizes its validation process before 31st December 2020.

3.2 Quantification of GHG Emission Reductions and Removals

3.2.1 Baseline Emissions

NOTE: Estimations of quantifications in this section are preliminary and subject to confirmation during first verification stage due to methodology deviation No. 3 described in section 3.1.6.

STEP 1: SELECT SPACIAL BOUNDARIES

Project area is the sum of forest concessions Otorongo and Chullachaqui

STEP 2: DESCRIBE SPATIAL BOUNDARIES OF THE DISCRETE PROJECT AREA PARCELS

The KML of the project is attached to the PD.

STEP 3: SELECT A VALID REFERENCE REGION

As described in 3.1.4, the reference region meets the attributes indicated in the methodology. It is over 250,000 ha. There is not biased because it is located in the same districts than the project area (and in very similar proportions). It does not include areas with restricted access and the forest cover is largely higher than 15% of total reference region area.

As can be seen in map, the drivers of deforestation are similar in reference region and project area, as both are geographically close between them. These are mainly expansion of agrarian frontier, mostly for corn production for regional market. Elevation and slope, among other components of landscape configuration confirm the similarities between both areas. Finally, land tenure in both cases is composed by forest concessions and agrarian plots and a few urban areas.

STEP 4: DATA SOURCES

Project only works with official information of the country. In this case, as Peru has only developed a methodology and systematic data series for deforestation, the project has only considered this activity as part of the REDD accounting. When Peru completes the methodological process for measuring degradation, the project will add this activity enhancing the significance of measurements. The methodology for generating the data may be reviewed in the webpage of MINAM[27].

STEP 5: DEFINE LULC CLASSES AND FOREST STRATA

Based on the same criteria, we have worked with the official stratification used by the Government of Peru, which are the eco-zones. In this case, in the project area and reference region, the whole area corresponds to the eco-zone “Selva Baja” so there is only one forest stratum. For LULC classes, there are 6 classes proposed by Peruvian State, to be coherent with chapter 2 of IPCC Guidelines about LULC 2003. The six classes are forest lands, croplands, pasturelands, wetlands, settlement and other lands in the LULC definitions.

[27] http://geobosques.minam.gob.pe/geobosque/view/index.php

"In a first step of the stepwise approach, MINAM classified the uses of Amazon deforested areas during 2000-2010 period, applying the 6 IPCC classes of land use: forest lands, croplands, pastures, wetlands, settlements and other lands, based on tier 2 of IPCC. Under this approach, a random stratified sample to estimate areas to each post-deforestation land use class. In a second step, the use and land use change in 4 Amazon regions (Madre de Dios, Ucayali, San Martin and Cajamarca) for 2011-13 period. It is planned that this method will be applied to quantify the net emissions from Amazon deforestation during years 2010, 2013, 2015 and 2017. At the same time, other monitoring methods are being evaluated to detect use and land cover in Coast and Andes using the same frequency. Since 2017, it is predicted to implement and operate a unique monitoring national system of use and land use change in order to generate activity data for MRV system, using new tele-detection technologies.	Source: Peru. Ministry of Environment. Strategic elements for REDD+ implementation. MINAM. National Program of Forest Conservation for Climate Change Mitigation, Lima: MINAM, 2015

TABLE 70: IPCC CLASSES IN PERUVIAN OFFICIAL INFORMATION

Land use classes	Sub-category	Symbol
Agricultural lands	Agriculture	Ag
Artificial lands	Settlements	As
Forestry lands	Forest	B
Wetlands	Wetlands	H
Pastures	Hydromorphic savannah	Sh
	Grasslands and pastures	P/H
	Scrubland	Pa
Other lands	Water areas	CA
	Mining	M
	Bare land	Td
	Secondary vegetation	Vs

Forestry lands

Definition: it comprises natural areas conformed mainly by tree elements of native species, with the existence of a more or less defined tree crown. According to FAO (2001). There is another natural canopy considered such as the case of the “pacales”.

For interpretation it is an area with trees higher than 5 m and a more than 30% canopy coverage within a Landsat pixel (resolution 30 m).

The definition includes forests from the following types of coverage:

Primary forests

Pacal forests

Fragmented forests

Dense forests

Open forests

Mature secondary forests: If they present similar characteristics to those of the primary forests.

Forestry plantations: if they comply with the characteristics of a primary forest

Operative definition: within the Landsat mosaic, with the combination of natural color (R:3 G:2 B:1), they present uniform characteristic for all their coverage, both in texture and color. It is important to highlight that this coverage presents bigger dimensions within the Amazon jurisdiction.

Pastures

Definition: this category includes grazing lands, grasslands that are not considered agricultural lands. It also includes

systems with non-forest vegetation (weeds) and other non-herbal vegetation such as pastures and weeds that do not meet the forest category. The category also includes all other types of grasslands, from non-farmed lands to silvo-pasture systems, coherent with the “national definitions”. This category includes

i. grasslands and pastures

ii. hydromorphic savannah

iii. scrublands from the high Andes

Operative definition: they present similar characteristics in some places such as agricultural lands, both in texture and color, the difference is in size, grass cover bigger areas than agricultural plots (Barrena y Vargas, 2003), as shown in picture 7. In Landsat images the combination of natural color (R:3 G:2 B:1) pastures present fuchsia and cherry colors in pale shades.

Agricultural lands

Definition: this category includes farmed lands and agro-silviculture systems where the structure of the vegetation is below the characteristics employed for the forests category. It also includes those areas dedicated to permanent crops, transient, heterogeneous agricultural areas where cattle ranching uses can also occur besides agricultural ones.

This category includes:

Transient crops

Permanent crops

Heterogeneous agricultural areas

Operative definition: agricultural lands present the same characteristics than Grass classes, both in color and texture, the difference is in size. In Landsat images the combination of natural color (R:3 G:2 B:1) agricultural lands present fuchsia and cherry colors with small pale shades, agro industrial plantations present a green color similar to that of the secondary vegetation.

Wetlands

Definition: this category includes areas where peat is extracted and land that is covered or saturated by water during all year or part of the year and can be partially covered by vegetation (for example “aguajales” and “varillales” and that it is not within the category of forest, agricultural land, grasslands and pastures or artificialized areas.

This category includes:

Aguajales

Varillales

Marsh areas

Peatlands

Operative definition: this category presents a uniform texture and variable color in big extension areas. In the Landsat images with combination of natural colors (R:3 G:2 B:1) wetlands present various colors, from an intense purple to a green blue color. This category is easy to detect because it is located within the selva baja.

Settlements

Definition: this category includes all developed land, including transport infrastructure and human settlements of any size, unless they are already included in other categories. This must be coherent with the national definitions.

This category includes:

Urban structure

Infrastructure

Operative definition: Being artificialized areas, this category presents an intense pink in the Landsat images, with a combination of natural color (R:3 G:2 B:1) because it does not present any type of vegetable coverage. Some parts present white colors due to the presence of streets and pavement.

Other lands

This category includes bare soil, rock and all other areas that are not included in any of the rest of the 6 aforementioned categories. It allows that the total of the identified lands coincide with the Amazon areas that will have available data.

This category includes:

Mining areas

Bare lands

Water courses

Secondary vegetation

Operative definition: this category includes various sub-categories when visualized with Landsat images in its combination of natural color (R:3 G:2 B:1). Mining areas are concentrated in a white with fuchsia color with blue pixels due to the presence of water, the secondary vegetation presents a light green non-uniform texture, the bare lands a fuchsia color without a defined spatial outline. In some place there are white colors due to the big quantity of streets and pavement.

Water areas

Definition: those units with the Amazonia that are comprehended by lakes, lagoons, “cochas”, deposits and natural or artificial freshwater basins, reservoirs and water in movement (rivers).

STEP 6: LAND TRANSITIONS BETWEEN LULC CLASSES / FOREST STRATA

TABLE 71: LAND TRANSITIONS

LULC classes / Forest strata	Cropland
Selva Baja	100%

As explained in Section 3.1.6, these transitions were not applied but the calculations were based on the post-deforestation land use with the highest emission factor (in this case, cropland) in order to be conservative.

STEP 7: MAP ACCURACY ASSESSMENT AND DISCOUNTING FACTOR DETERMINATION

Accuracy Assessment. The accuracy assessment allows the user to value the degree of similarity among maps and reality. To assess data accuracy, a statistic validation of the whole map of forest cover loss was done. For sampling, a stratified random method was used to divide the research are in two strata: areas with the highest risk of land change and areas with the lowest risk of land change. From those strata, as requested by the methodology for an area larger than 500 sq. km, each stratum must have 75 plots. In this case, as the project zone has 6996 sq. km, 75 plots are required for forest stratum and 75 for non-forest stratum.

The procedure, described in detail in Annexes, uses SENTINEL high-resolution satellite images to assess the official maps developed by MINAM. This has been already done by MINAM and independent third-parties hired by MINAM. The reason why those official accuracy assessments were not used is because the methodology requests that plots were located within project zone and plots location is not available. For this reason, the same method was followed by project proponent and results were similar, with the Global Accuracy of 90%. Other values were between 94 to 98% but with the difference that the percentage of plots in forest stratum in those works were significantly higher and this stratum use to have a higher accuracy. In any case, the value obtained is higher than 85% so the discount factor is still 1.

TABLE 72: CONFUSION MATRIX

Interpretation	FOREST	NON-FOREST	User Accuracy	

Map				Commission Error
FOREST	73	2	97%	3%
NON-FOREST	13	62	83%	17%
Producer Accuracy	85%	97%	**Global Accuracy**	
Omission Error	15%	3%		**90%**

According to table 6 of the methodology, the number of images is 10, which implies that no discount is applied at this level. On the other side, the accuracy attained for that classification was 97.33% so the discount factor that corresponds to $u_{classification}$ is 0.9733.

According to section 8.1.2.7 of the methodology, the discount factor for LULC is determined in three steps:

TABLE 73: STEPS TO CALCULATE THE DISCOUNT FACTOR FOR LULC

Step 1: determine the accuracy of LULC classification of each map creating a confusion matrix	Step 2: multiply the accuracy of LULC classification of step 1 with a factor obtained from the lower accuracy of all maps (table 5)	Step 3: multiply the factor of step 2 with a factor based on the number of images in the historical reference period to obtain $u_{classification}$ (table 6)
0.9733	1.00	1.00

Accuracy was determined by MINAM (2011) in the Land Use Map Validation Report 2011 for Amazon biome – REDD+ Project. The value obtained, 97.33%, Table 5 indicates that, for an accuracy of 85% or higher, the factor is 1; this new result is multiplied by the factor of table 6, which is 1 again, considering that the number of images available is more than 3. The final $u_{classification}$ result is 1.00.

Information to be reported with respect to remote sensing and other spatial data employed for assessing deforestation and forest degradation.

TABLE 74: ATTRIBUTES OF REMOTE SENSOR DATA

Information Needed about the Data Collected	
Source Type	Landsat 7 Images ETM+
Resolution (spatial and spectral)	Spatial Resolution 30 m and Spectral resolution 8 bands
Acquisition date	2008 to 2017
Coordinate system and pre- processing	WGS84 - 18S
Minimum Mapping Unit (ha) Description of method used to produce these data	30 m
Descriptions of the LULC classes and/or LULC-change categories	Forest/Non Forest- Loss/ No change
Source Type	RapidEye
Resolution (spatial, spectral) Acquisition date	5 m – 2017

Coordinate system and pre-processing	WGS84 - 18S

TABLE 75: ANALYSIS OF CONFORMANCE OF MAPS WITH METHODOLOGY REQUIREMENTS

Methodology Request	Analysis
- The average location error between 2 images must be less or equal to 1 pixel	
- Clouds or shadows must be masked and excluded when calculating deforestation rate	All the images used in the process were masked for clouds, shadows and mist
- The maximum allowed of clouds is 20% for one image or 20% as an average of pairs of images used in the analysis of transition rate	The work has been done only with normalized images with less than 5% of clouds, shadows or mist
- A forest reference map must be generated to show the status of forest cover in project area and leakage belt	Annual measurements from 2008 to 2017 corresponding to series developed to obtain the best cloud-free images, since 2008 to 2017. First (2008) and Last (2017) show a set of cloud-free observations since the start of 2008 (First) and the last cloud-free observation for 2017 (Last)
The estimation of GHG benefits in the project area and leakage belt after the start of the project must include only cloud-free images	Three cloud-free observations were selected for years 2000 (Med-First) and 2017 (Med-Last). From these observations, the mean and median for bands 3, 4, 5, 7, NDVI and NBR are used for visual analysis and product assessment as these data are less sensitive to the noise. In the composition of metrics, it is always prioritized the use of pixels of year of analysis and, in the case, there are not pixels, neighboring years are used.

STEP 8: ASSESS THE RELATIVE IMPORTANCE OF DEFORESTATION DRIVERS

Alarcon, *et al*. (2016) indicates in its study that the Peruvian Amazon has the fourth largest accumulated forest loss in the region (9.1%) between 2010 and 2013. Agriculture and livestock are the most important direct causes of deforestation, but since 2009 agro-industrial plantations (palm and cocoa), which demand ever-increasing areas of primary forest, are a growing threat. In particular, in Madre de Dios Region, the main cause of deforestation is alluvial gold mining, in addition to the accelerated immigration of the people of the Andean region, the rise of gold in the international market and the inadequate policies of the Peruvian government in territorial order (2002-2010).

Madre de Dios was on the sidelines of the presence of the State and most of the rest of the national population until the early years of the twentieth century. From 1930 on, Brazil nuts (Bertholletia excelsa) began to be used for export. The construction of penetration roads to the basin from the Andean mountain range began during the first government of President Fernando Belaúnde, in the 1960s. These roads were accompanied by rural settlement projects driven by the Peruvian state. Andean migrants who arrived deforested areas of several kilometers on either side of the roads for their crops, mainly rice, and grasslands for cattle farming, degrading tropical soils and reduced vast expanses of wild Brazil nut. However, these were abandoned due to the unproductivity of the soils, being covered by invasive species such as the paca (Guadua spp.). In addition, the roads made way for the loggers who installed, along them, small sawmills that in a few years wiped out the trees of the most valuable species, such as mahogany (Swietenia macrophylla), cedar (Cedrela odorata), screw (Cedrelinga cateniformis), and ishpingo (Amburana cearensis). The Interoceanic Highway was planned since 1983 and was only completed between 2005 and 2011, with an investment of more than $4.5 billion. To accompany this process, the

Peruvian State assumed in 2006 an additional credit from the Andean Development Corporation (CAF) for $10 million, plus the contribution of another $7,785,957 by the State through the National Institute of Natural Resources (INRENA) to advance the process of territorial ordering of the Interoceanic Highway environment, in order to mitigate its impact. The tasks included the legal physical sanitation of rural property, among other interventions, through the Regional Government of Madre de Dios (GOREMAD).

Gold mining, took off in 1978, when Andean gold miners discovered gold concentrated in ancient channels of the Madre de Dios River two and more meters deep. This finding led to a massive boom in gold mining in similar locations throughout the Inambari, Malinowski, Huepetue, Kaichiwe, Pukiri and Madre de Dios river areas, using heavy machinery to remove overload. This extended the deforestation of large areas that had previously been covered by primary forests using front loaders, track tractors and large trucks to move the land. What has led to the most intense conflicts and the greatest deforestation has been the Peruvian government's policy of prioritizing mining rights over the ordering of processes, as well as the adoption of inappropriate legal standards for the area and socio-environmental reality. In 2012, a set of legislative decrees was issued in an attempt to control illegal mining. These rules established procedures for the interdiction of illegal mining, beginning with dredgers that undermined the banks of the main course of the Madre de Dios River. The new legislative decrees incorporated modern technical criteria but no knowledge of the socio-environmental reality of the area. Currently, this activity is located in the southeastern part of the Region so it is not considered within the drivers of deforestation.

Agriculture, livestock and agribusiness, in 2012 the total area of land under agricultural cultivation was 68 900.78 ha, while the area planted in natural pastures was 30 133.54 ha. Both activities are mostly located on the sides of the Interoceanic Highway. Previously, there were premises of up to 300 ha, but they have been plotted in smaller units, from three ha, although most range from 20 to 100 ha. An analysis carried out in 2014 by the Madre de Dios Consortium records 32,243.49 has deforested at the heart of the current Interoceanic Highway in 1999, when the road had not yet been completed, which does not include areas subsequently occupied by informal gold miners. Such deforestation would also have reached 77 684.75 ha in 2013, when the mining operations of La Pampa and Guacamayo were already active. Most of the deforestation, generated by gold mining, would be on the stretch between Puerto Maldonado and the Inambari Bridge. Another critical factor will be forest logging for papaya and cocoa crops, mostly on the stretch of road between Puerto Maldonado and Iñapari.

In addition to traditional crops such as rice, yellow maize, banana and cassava, and some permanent crops such as citrus. The opening of the Interoceanic Highway has entered farmers from other parts of the Peruvian jungle, such as Ucayali, San Martín and Loreto, who have introduced papaya and cocoa crops to the national market. The ACCA MAAP Project has documented the 204 ha deforestation of forest for the cultivation of papaya by the Interoceanic Highway in 2015, compared to 55 ha in 2014 (Finer et al., 2016). Since the monoculture of papaya began several years earlier and continues, and we are aware of papaya plantations along the Madre de Dios and De las Piedras rivers, in addition to the Interoceanic Highway, the threat of deforestation for this purpose will probably be substantially greater than reported so far. Another crop that is entering is sacha inchi (Plukenetia volubili). Data on its extent or deforested areas are not yet available, but it is yet another example of development planning based on ephemeral markets rather than sustainable production. Now the Ministry of Agriculture and Irrigation (MINAGRI) has been promoting the Sierra y Selva Exportadora program, with support from the Ministry of the Environment (MINAM), and funding from the Andean Development Fund (CAF).

The extraction of wood has been carried out in small areas by local people, mostly residents in the area. This situation changed from 2000, when the new Forestry Law 27308 was passed and forest concessions of up to 50,000 ha were initiated with management plans, which were never adequately supervised. This Law allowed the determination of permanently produced forests in Madre de Dios of 2'522,141 hectares that were declared suitable for the preferential use of wood and other forest resources and wildlife. As of

2003, 82 forest concessions had been granted for timber purposes in permanently produced forests over an area of 1 248 037 ha (SERFOR, 2013).

The area with the most timber concessions is the north of Tambopata province and most of Tahuamanu province, where loggers entered forests away from the De las Piedras and Tahuamanu rivers in a disorderly manner and without proper controls, and swept through the mahogany and red cedar of the area. This situation was partially remedied when mahogany was included in Appendix II to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and its legal marketing was limited to production with certified management under international standards, limiting the export possibilities of mahogany that did not meet these requirements.

Another outstanding problem is that different entities, who grant different rights (forest, soils, sub-soil) do not coordinate, often overlapping between the different public sectors, and the inability of the State to expire the private rights previously established to give way to territorial order, however, however that theoretically forests and minerals belong to the State. This confusion continues to lead to deforestation, despite the technical criteria of professionals in each sector.

From the above, we conclude that the main deforestation agents of the project are: Farmers, Ranchers and infrastructure.

STEP 9: MOBILITY OF EACH DEFORESTATION DRIVERS

The deforestation drivers are in all the cases rural families, local communities or former migrants, so the access to production areas are mostly with motorcycles.

STEP 10: DETERMINE AND CALCULATE EMISSION FACTORS

We have taken official data from Peruvian Government for emission factor of forest stratum “Selva Baja” and for emission factor of LULC, we have collected from the REDD+ project previously mentioned. Data is presented in Table 43.

TABLE 76: CARBON STOCK IN LULC CLASSES AND FOREST STRATUM

Forest stratum / LULC classes	AGL (tC/ha)
Forest stratum “Selva Baja”	138.84
LULC Class: cropland	0.36

0.36 was obtained from Zhu et al. (2019) in "Estimation of maize above-ground biomass based on stem-leaf separation strategy integrated with LiDAR and optical remote sensing data ", in table 5, the value with the highest R2 was taken (72.28 g / m2 is equal to 0.72 t / ha), this value was multiplied by the carbon fraction 0.5, resulting 0.36.

Based on those data, we can calculate the emission factor for all the transitions, by using EQ26 – EQ30:

$$EF_{AGL}(CS1 \rightarrow CS2) = \frac{44}{12} \cdot \left(C_{AGL}(CS2) - C_{AGL}(CS1)\right) \quad \text{[EQ26]}$$

where:

EF_{AGL} *(CS1→CS2)*	=	Emission factor for change in aboveground live plant organic matter from an LULC Class or forest Stratum (CS) 1 to 2. [$tCO_2e\ ha^{-1}$]
(CS1→CS2)	=	Land transition from LULC class or forest stratum 1 to 2
$C_{AGLF}(i)$	=	Carbon density of aboveground plant organic matter of classes or forest stratum ii. [MT C ha^{-1}]

As allowed by the methodology, non-CO2 gases are omitted and it is the same for other pools (soil organic carbon and dead wood.).

TABLE 77: EMISSION FACTOR PER TYPE OF LAND TRANSITION

Forest stratum	LULC class	AGL
Selva Baja	Cropland	-506.79

The belowground biomass and the aboveground deadwood factors was gradually spread overtime

It must be noted that this value are conservative if compared with the carbon content estimated from the exploratory inventory of forest concession. Calculations are available for comparison.

TABLE 78: THE UNCERTAINTY DISCOUNTING FOR ESTIMATED EMISSIONS FACTORS FOR A TRANSITION FROM ONE STRATUM TO ANOTHER

Forest stratum	LULC class	
Selva Baja	Cropland	0.94

TABLE 79: Uncertainty of biomass stock density in SELVA BAJA stratum

Parameter	Media (t/ha)	Standard Deviation	Sampling size	Confidence level	Sampling error (%)	gl	Standard error	HCWI(OM)
Live AGB	295.41	11.02	119	95%	3.73	118	1.010202	1.67478268
BGB	77.27	2.88	119	95%	3.73	118	0.264009	0.43769275
Standing dead AGB	0.006	0.001	119	95%	11.72	118	9.17E-05	0.00015198
Lying dead AGB	15.59	0.22	77	95%	1.41	76	0.025071	0.04174755

$$HCWI(OM_o(i)) = t_{0.95,n-1} \cdot stderr(OM_o(i))$$

$$CE_{inventory}(i) = \frac{\sqrt{\sum_o HWCI(OM_o(i))^2}}{\sum_o OM_o(i)}$$

$$u_{inventory}(i) = \begin{cases} 1 & \text{if } CE(i) \leq 0.15, \\ 1 - CE(i) & \text{if } 0.15 < CE_{inventory}(i) < 1, \\ 0 & \text{if } CE(i) \geq 1 \end{cases}$$

$$u_{inventory}(i): 1$$

$$CE_{inventory}(i): 0.005$$

TABLE 80: FOREST COMPOSITION PER ECOZONE

Variables	Coast	Highlands	Selva Baja	Selva Alta accessible	Selva Alta of difficult access	Hydromorphic
Tree density/ha*	10.7%	10.7%	3.3%	7.1%	9.6%	10.0%
Basal area/ha*	12.0%	12.0%	3.8%	8.3%	11.6%	12.0%
Volume/ha*	10.9%	10.9%	3.3%	7.3%	10.1%	10.4%
Density of stem wood/ha**	17.7%	17.7%	5.8%	10.5%	17.5%	17.2%
Latizales/ha***	15.6%	15.6%	5.2%	10.5%	14.0%	14.3%
Briznales/ha****	16.9%	16.9%	6.0%	12.1%	18.1%	18.4%

* Trees ≥ 10 cm DBH (coast and highlands), ≥ 30 cm DBH (Selva Baja, SA accessible, SA difficult and hydromorphic)

**Stem wood 5 □DBH□10 cm DBH (coast and highlands), 10 < DBH < 30 cm (Selva Baja, SA accessible, SA difficult and hydromorphic)

***Latizales □5cm diameter 30 cm from the ground, 1-3 m total height (coast and highlands), 3 m total height (Selva Baja, SA accessible, SA difficult and hydromorphic)

**** Briznales 0.3 - 1m of total height (coast and highlands), 1-3 m total height (Selva Baja, SA accessible, SA difficult and hydromorphic)

Source: Barrena et at (2013)

Fuente: INF 2019

Referred to emissions factors, the INF states: Results of current research does not represent emission factors, but carbon content for each pool, because emissions factors refer to changes or transitions between different categories or land uses. Carbon content are measured in carbon tons or biomass tons per hectare (tC/ha or t/ha) and not in tons of CO2e per hectare (tCO_2/ha). Its application as emissions factors will depend on the available information about carbon content in other land uses (in case the transition occurs) or, if no data will be available, it will be assumed immediate oxidation and total loss of carbon content, when the change happens.

TABLE 81: CONFORMANCE ANALYSIS OF MEASUREMENT SAMPLING WITH METHODOLOGY REQUIREMENTS

<table>
<tr><td>Methodology (field inventory, extrapolation of satellite images, ecosystem model or GIS analysis)</td><td colspan="4">Field inventory with sampling in measurement plots, called Sampling Units</td></tr>
<tr><td rowspan="7">Number of plots measured</td><td colspan="4">Number of sampling units per ecozone</td></tr>
<tr><td>Ecozona</td><td>Total Units</td><td>Accessible Units</td><td>Size of the square (km)</td></tr>
<tr><td>Selva Baja</td><td>808</td><td>804</td><td>24</td></tr>
<tr><td>Hidromórfica</td><td>91</td><td>88</td><td>31</td></tr>
<tr><td>Accessible Selva Alta</td><td>288</td><td>261</td><td>20</td></tr>
<tr><td>Difficult to access Selva Alta</td><td>101</td><td>101</td><td>34</td></tr>
<tr><td>TOTAL in Amazonia</td><td>7293</td><td>1855</td><td></td></tr>
<tr><td>¿Are all the species included in the sample?</td><td colspan="4">Yes, all the species with a DBH > 10cm</td></tr>
<tr><td>¿Which is the minimum DBH of trees sampled?</td><td colspan="4">10 cm DBH</td></tr>
<tr><td>¿Regions where samples were taken?</td><td colspan="4">All the ecozones with a sampling size of 1855 units</td></tr>
<tr><td>Demonstration that all the data sources for biomass stock density based on classes of section 8.1.4.2 of the methodology were consulted</td><td colspan="4">Forest and Wildlife National Inventory</td></tr>
<tr><td>Information about source of carbon stock densities in non-forest land cover of the project</td><td colspan="4">Zhu, Yaohul and others. “Estimation of maize above-ground biomass based on stem-leaf separation strategy integrated with LiDAR and optical remote sensing data” in PeerJ[28]</td></tr>
</table>

STEP 11: CALCULATE TOTAL RATES OF DEFORESTATION AND DEGRADATION IN THE PROJECT AREA

By using the Beta regression proposed by the methodology, the results are as follows:

[28] Estimation of maize above-ground biomass based on stem-leaf separation strategy integrated with LiDAR and optical remote sensing data (nih.gov)

TABLE 82: BETA REGRESSION

	Beta regression describes the relationship between time and deforestation rate in reference region during reference historical period [ha/year]	Project area [ha]	Reference Region [ha]	Deforestation in project area in baseline scenario [ha/year]	Carbon emission from deforestation within the project area during the year. [tCO2e/year]
2008	2,828.39	183015.28	516554.21	1,002.10	-508,825.87
2009	1,078.82			382.23	-194,079.63
2010	1,834.21			649.86	-329,972.88
2011	2,234.93			791.84	-402,063.37
2012	1,371.70			485.99	-246,768.39
2013	2,332.08			826.26	-419,540.52
2014	3,482.57			1,233.88	-626,513.05
2015	3,879.69			1,374.57	-697,953.60
2016	4,257.29			1,508.36	-765,885.16
2017	5,919.62			2,097.32	-1,064,935.98
2018	6,025.72			2,134.92	-1,084,024.65
2019	6,941.48			2,459.37	-1,248,769.35
2020	7,974.69			2,825.43	-1,434,642.67
2021	9,132.64			3,235.70	-1,642,956.72
2022	10,420.05			3,691.82	-1,874,560.87
2023	11,837.69			4,194.10	-2,129,594.76
2024	13,380.69			4,740.78	-2,407,179.48
2025	15,036.44			5,327.41	-2,705,047.54
2026	16,782.27			5,945.96	-3,019,122.53
2027	18,583.02			6,583.97	-3,343,075.36

After calculation the annual deforestation rate in the project area in the baseline scenario, we apply EQ1 and results obtained are in table 82.

$$L(1) = CF \cdot \sum_{i=1}^{nrStrata} \left(\Delta area_{cropland,baseline}(i) \cdot \left(OM(i) - OM(cropland) \right) \right)$$

Where:

CF: Carbon fraction of dry matter (default = 0.5). [Mg C (Mg DM)$^{-1}$]

$\Delta area_{cropland,baseline^{(i)}}$:

Forest area converted from forest stratum ii to cropland at the beginning of the crediting period. [ha yr.$^{-1}$]

Table 83: CONVERSION OF FOREST LAND TO CROPLAND FOR SUBSISTENCE FARMING

Year	Forest area converted from forest stratum to cropland at the start of crediting period (ha/year)	OM (i): Organic matter for forest stratum according to INFF (2019). [Mg.dm/ha]	OM (cropland): Average organic matter in croplands	OM (i) - OM (cropland)	L (1): Annual carbon loss by conversion of forest lands in croplands [Mg.C/year]
2018	2134.92	295.41	0.72	294.69	314569.11
2019	2459.37	295.41	0.72	294.69	362375.77
2020	2825.43	295.41	0.72	294.69	416313.66
2021	3235.70	295.41	0.72	294.69	476763.55
2022	3691.82	295.41	0.72	294.69	543971.90
2023	4194.10	295.41	0.72	294.69	617979.24
2024	4740.78	295.41	0.72	294.69	698530.53
2025	5327.41	295.41	0.72	294.69	784967.76
2026	5945.96	295.41	0.72	294.69	876108.02
2027	6583.97	295.41	0.72	294.69	970114.70

Applying the following equations of the methodology:

$$\Delta C_{DF} = \sum_{d=1}^{nrDrivers} proportion_{DF}(d) \cdot L(d)$$

$$contribution_{DF}(i) = \frac{proportion_{DF}(d) \cdot L(d)}{\Delta C_{DF}}$$

We obtain that the total carbon loss caused by deforestation is similar thanks to the fact that the proportion of gradual loss of carbon that conducts to forest deforestation ($proportion_{DF}(d)$) is 100% and, as a consequence, the relative contribution of driver 1 to total deforestation is 100% too.

Regeneration is not significant and is omitted.

STEP 12: CALIBRATE AND VALIDATE A SPATIAL MODEL

As described in Chart 3, a statistical analysis was done to compare which is the most accurate statistical equation based on historical reference region deforestation data and the polynomial equation was chosen.

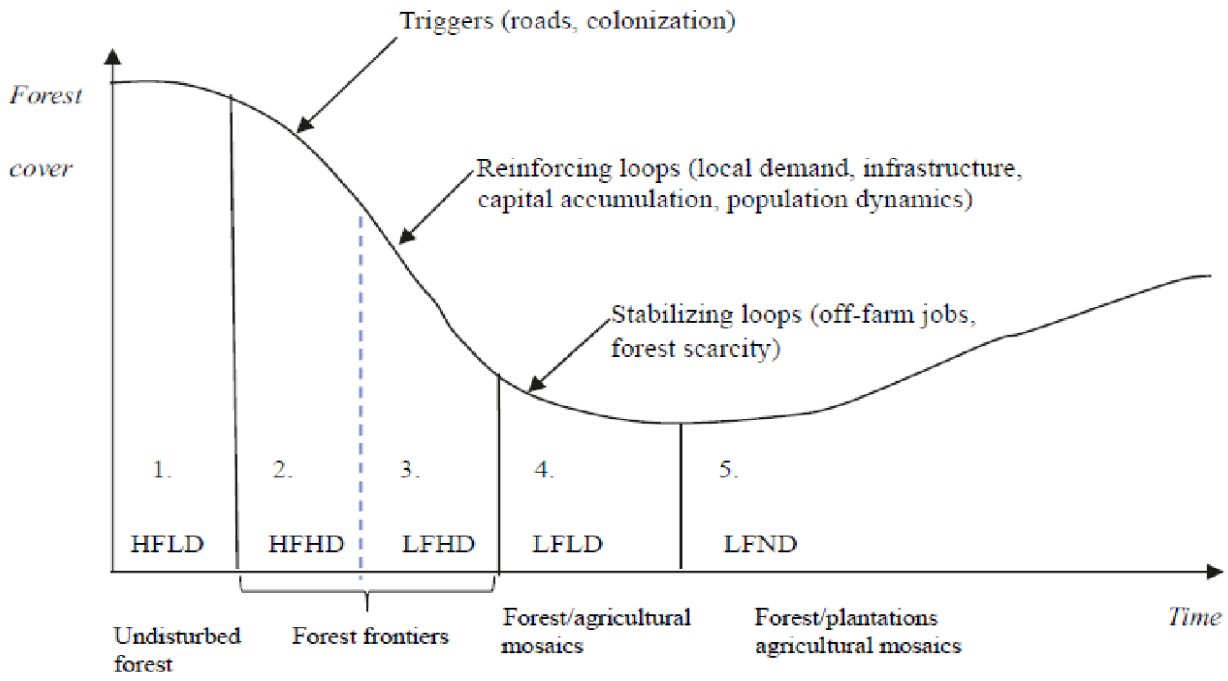
Regarding factor scarcity, we fully agree with the concept of forest transition model. Even more, we encourage to be used at all levels. Our main critic to most of standards and results based payment mechanisms is the pressure to recipients to use the historical average of forest loss, which is totally unfair and unrealistic. In some cases, it may underestimate the level of upcoming threat and, in other cases, it may overestimate by allocating financial resources that could be better employed in other regions, programs or projects.

For the case of Peru, we have done a very specialized analysis comparing historical data and peer-review.

First, we need to introduce the concept of forest transition curve.

This concept was originally introduced by Matter (1992) and improved by Angelsen (2007), and basically explains why forests have different deforestation rates throughout their lifetime. Angelsen, not only shows a time path, but gives a conceptual framework that explains why it happens.

CHART 9: FOREST TRANSITION CURVE



HFLD: high forest, low deforestation jurisdictions,

HFHD: high forest, high deforestation jurisdictions

LFHD: low forest, high deforestation jurisdictions

LFLD: low forest, low deforestation jurisdictions

LFND: low forest, no deforestation jurisdictions

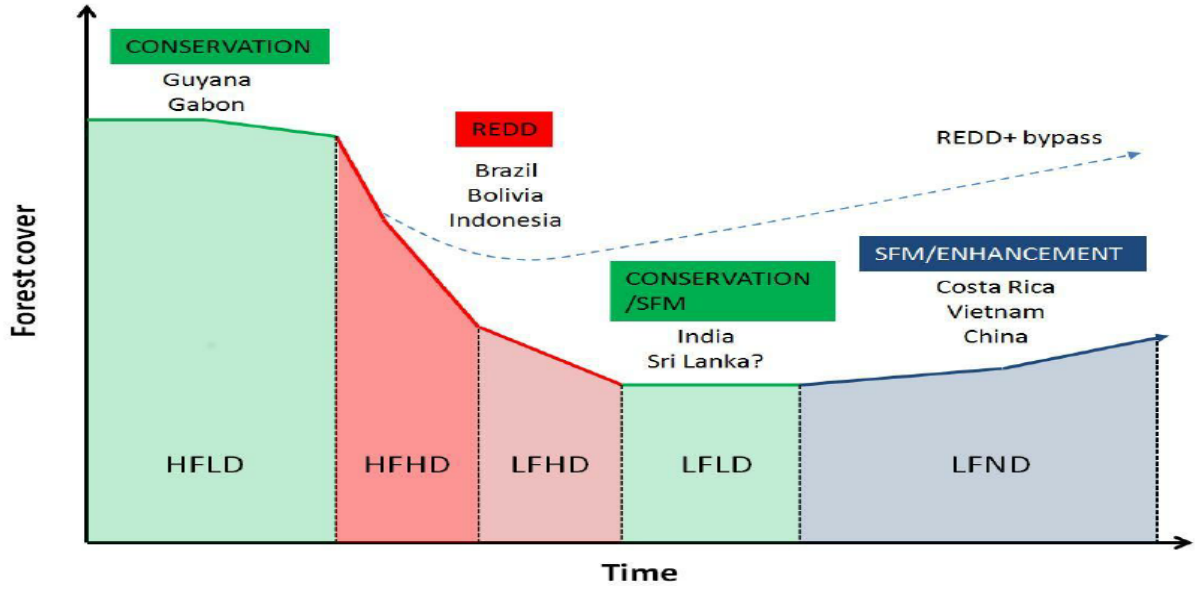
Source: Angelsen (2007)

This hypothesis largely studied and presented in many academic papers[29], mainly proposes that the deforestation rate is dynamic and changing and not permanent along the lifetime of forest areas.

> "the FT describes a sequence where a forested region goes through four stages: (1) initially high forest cover and low deforestation, (2) accelerating and high deforestation, (2) slow-down of deforestation and forest cover stabilization and (4) a period of reforestation."[30]

So, HFLD forest areas, at some point will become HFHD areas, with a growing deforestation rate, and, lately, at some point, LFHD areas, with a decreasing deforestation rate and, finally, the net rate will be zero, with the forest cover stabilized (but after large areas were lost) and even restored with net gains on forest cover. Following graphs show the location of some countries in the segment of the FTC.

CHART 10: FOREST TRANSITION CURVE BY COUNTRIES

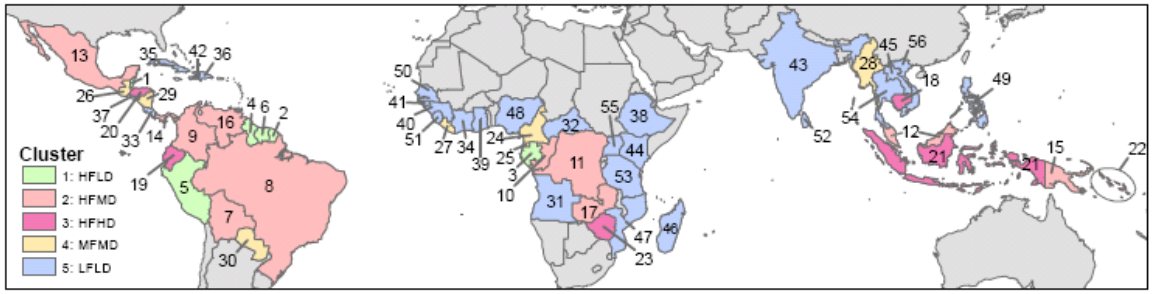


Source: Mattsson, E. (2012).

Having that defined, we must evaluate at what segment Peru belongs. According to all the sources revised (peer-review analysis), Peru is an HFLD country as can be seen below.

[29] Angelsen (2007), Griscom (2009), Leischner (2011), Duchelle (2014), Ferrer (2020), Dong-hwan (2020)
[30] Angelsen (2009)

CHART 11: MAP OF FOREST TRANSITION CURVE



Cluster 1: HFLD
1 - Belize
2 - French Guiana
3 - Gabon
4 - Guyana
5 - Peru
6 - Suriname

Cluster 2: HFMD
7 - Bolivia
8 - Brazil
9 - Colombia
10 - Congo
11 - Congo, DRC
12 - Malaysia
13 - Mexico
14 - Panama
15 - Papua New Guinea
16 - Venezuela
17 - Zambia

Cluster 3: HFHD
18 - Cambodia
19 - Ecuador
20 - Honduras
21 - Indonesia
22 - Solomon Is.
23 - Zimbabwe

Cluster 4: MFMD
24 - Cameroon
25 - Equatorial Guinea
26 - Guatemala
27 - Liberia
28 - Myanmar
29 - Nicaragua
30 - Paraguay

Cluster 5: LFLD
31 - Angola
32 - Central African Republic
33 - Costa Rica
34 - Cote d'Ivoire
35 - Cuba
36 - Dominican Republic
37 - El Salvador
38 - Ethiopia
39 - Ghana
40 - Guinea
41 - Guinea-Bissau
42 - Haiti
43 - India
44 - Kenya
45 - Laos
46 - Madagascar
47 - Mozambique
48 - Nigeria
49 - Philippines
50 - Senegal
51 - Sierra Leone
52 - Sri Lanka
53 - Tanzania
54 - Thailand
55 - Uganda
56 - Vietnam

Source: Griscom et al (2009)

Other papers also locate Peru in the HFLD countries Cluster.

> "The Guiana Shield, along with Belize, Gabon and Peru, is part of what is commonly considered as HFLD countries (Dezécache, 2018).

CHART 12: FOREST TRANSITION CURVE BY RATES

Forest transition of FCPF and UN-REDD countries

	High Deforestation Rate (> 0.5% year)	Low Deforestation Rate (< 0.5% year)
High Forest Cover (> 40%)	Indonesia, Papua New Guinea, Lao PDR, Bolivia, Paraguay, Nicaragua	Democratic Republic of Congo, Colombia, Guyana, Panama, Peru, Costa Rica
Low Forest Cover (<40%)	Nepal, Ethiopia, Ghana, Liberia, Tanzania, Uganda	Vietnam, Kenya, Madagascar, Mozambique

(USAID, 2015)

This is the reason why Peru Government has proposed a Forest Reference Emissions Level for 2015-2020 period based on a growing linear trend (Pulgar-Vidal, 2016) as shown in the following graph:

TABLE 84: FOREST REFERENCE EMISSION LEVEL FOR GROSS ANTROPIC DEFORESTATION FOR PERUVIAN AMAZON

Departamento	2015	2016	2017	2018	2019	2020
	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
AMAZONAS	1,990,284	2,043,974	2,097,664	2,151,354	2,205,044	2,258,734
AYACUCHO	308,301	316,705	325,109	333,513	341,917	350,321
CAJAMARCA	365,912	370,341	374,770	379,199	383,628	388,057
CUSCO	1,590,410	1,606,157	1,621,903	1,637,650	1,653,396	1,669,143
HUANCAVELICA	19,811	20,072	20,334	20,595	20,856	21,118
HUANUCO	11,951,959	12,476,312	13,000,665	13,525,019	14,049,372	14,573,726
JUNIN	3,645,646	3,741,938	3,838,229	3,934,520	4,030,812	4,127,103
LA LIBERTAD	22,975	23,701	24,427	25,153	25,879	26,605
LORETO	16,399,010	17,141,188	17,883,367	18,625,545	19,367,724	20,109,902
MADRE DE DIOS	7,430,080	7,799,952	8,169,823	8,539,694	8,909,566	9,279,437
PASCO	4,394,526	4,604,194	4,813,861	5,023,529	5,233,197	5,442,865
PIURA	37,061	33,296	29,531	25,767	22,002	18,237
PUNO	691,687	720,345	749,003	777,661	806,319	834,977
SAN MARTIN	12,313,646	12,611,516	12,909,386	13,207,255	13,505,125	13,802,995
UCAYALI	16,409,177	17,287,478	18,165,780	19,044,081	19,922,382	20,800,684
Total anual	**77,570,486**	**80,797,169**	**84,023,853**	**87,250,536**	**90,477,220**	**93,703,903**
Total acumulado	**159,135,802**	**239,932,971**	**323,956,824**	**411,207,360**	**501,684,580**	**595,388,483**

Nota: Las proyecciones que se muestran en esta tabla se realizaron proyectando linealmente los datos de emisiones históricas por deforestación antrópica bruta de cada departamento de la Amazonía Peruana

This is completely consistent with the concept of FT curve and the classification of Peru as a HFLD country.

According to GEOBOSQUES, only 3.2% of total forest area has lost in Peruvian Amazon, which is largely far from the 50% that the methodology mentions as the threshold when the deforestation rate starts to decrease. But even more, in Madre de Dios, 2.6% of natural forests have lost. This explains why Madre de Dios has one of the steepest growth of deforestation rate in Peru.

For those reasons, and based on peer-review and official data, we determined that scarcity factor is far to be achieved in the short term.

3.2.2 Project Emissions

NOTE: Estimations of quantifications in this section are preliminary and subject to confirmation during first verification stage due to methodology deviation No. 3 described in section 3.1.6.

As explained before, there is one sources of emissions in baseline scenario:

- From deforestation for croplands

The assumption of effectiveness is presented in the following table:

TABLE 85: EFFECTIVENESS FACTORS FOR EVERY COMBINATION OF PROJECT ACTIVITY AND DRIVER OF DEFORESTATION AND FOREST DEGRADATION

Target driver	Project activity	effectiveness quantification
Conversion of forest land to cropland	Alternative livelihoods	0.312
	Legal recognition of the land tenure status	0.040
	Demarcation and forest protection	1.000

The maximum effectiveness (100%) is being assumed since first year as the project proponent has large experience in controlling project boundaries. It does not mean that they will immediately change the land use pattern in surrounding communities and drivers of deforestation. In the leakage cancellation rate, a large discount has been assumed, associated to Arca Pacahuara maintaining current agrarian expansion, that will displace the threat to leakage area.

Specific measures to prevent fires were adopted. As an example, in 2019, firewalls were established to avoid the increase in forest fires. Firewalls emissions were accounted in NER calculations. Also, other social engagement activities as training in controlled burns and agroforestry projects implementation, aiming a more efficient use of soil. These prevention measures give an effectiveness of 50%. In addition, the Master Plan of Permanente Production Forests is being prepared, with one of its main objectives is the prevention of social conflicts and the enhancement of governance in the zone.

TABLE 86. PROCEDURES TO QUANTIFY THE MAXIMAL EFFECTIVENESS OF ALTERNATIVE LIVELIHOODS FOR TARGET DRIVERS

Target driver	Maximal effectiveness quantification
• Conversion of forest land to cropland	Effectiveness = $0.75 * \frac{S/.\ 119800}{S/.\ 2880}$ Effectiveness = 31.20

The proof is that the concessions are already FSC certified, which guarantees the sustainable forest management that includes the logging operations. Therefore, there are no plans to diminish the volume harvested as it already did when the FSC certification was obtained.

On the other side, the project proponent expects that the activities proposed in the theory of change reduce the whole pressure and threat on project area as they are focusing on creating alternative income sources for surrounding families with the objective to change the pattern of land use.

TABLE 87. TRANSITIONS FROM FOREST TO NONFOREST RATES IN THE PROJECT AREA UNDER THE PROJECT SCENARIO FOR EVERY YEAR OF THE CREDITING PERIOD

Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027

Area to be converted in cropland in project scenario	373.61	430.39	494.45	566.25	646.07	733.97	829.64	932.3	1040.54	1152.19

The area that will convert in cropland within the project zone is 17.5% of projected deforestation in the baseline scenario.

Forest impact of a driver "d" in deforestation and forest degradation, respectively at the moment "t" of crediting period is in EQ64.

$$RelativeDriverImpact_{DF}(t,d) = \sum_{a=1}^{nrActivities} \left(rate(a,t) \cdot effectiveness(a,d) \cdot contribution_{DF}(d)\right) \quad \text{[EQ64]}$$

The rate is 100% for the years 2018-2020 and 83.5% for the rest of the years, the effectiveness is obtained from tables 75 and 76 and the contribution is 100%. As a consequence, the relative driver impact is 1.13.

Then, considering that there is only one driver, the relative impact would be 1.13, according to EQ66.

$$RelativeProjectImpact_{DF}(t) = \sum_{d=1}^{nrDrivers} RelativeDriverImpact_{DF}(t,d) \quad \text{[EQ66]}$$

The deforestation rate in the project scenario is obtained multiplying the deforestation rate in the baseline scenario because of the relative impact on the project, according to EQ68.

$$D_{projectArea,projectScenario,DF}(t) = RelativeProjectImpact_{DF}(t) \cdot D_{projectArea,baselineScenario,DF}(t) \quad \text{[EQ68]}$$

TABLE 88: DEFORESTATION RATE IN THE PROJECT SCENARIO

Year	Absolute rate of deforestation in project area (ha/year)
2018	-751.49
2019	-865.70
2020	-994.55
2021	-951.04
2022	-1085.10

2023	-1232.73
2024	-1393.41
2025	-1565.83
2026	-1747.64
2027	-1935.16

ESTIMATE GHG EMISSIONS SOURCES FROM FIREBREAKS

Trees were cut to open firebreaks as a prevention measure. Emissions caused by this measure were accounted through EQ70 after being discounted the GHG emissions reductions caused by project activities. This activity was carried out in year 2019.

$$GHG_{fireBreaks} = \frac{44}{12} \cdot \sum_{i=1}^{nrFireClasses} area_{biomassLoss}(i) \cdot \left(C_{AGL}(i) + C_{AGD}(i) + C_{BG}(i)\right) + \sum_{i=1}^{nrStrata} area_{fireBiomassLoss}(i) \cdot \left(C_{AGL}(i) + C_{AGD}(i) + C_{BG}(i)\right) \cdot \frac{16}{12} \cdot GWP_{CH4} \cdot ER_{CH4} \quad \text{[EQ70]}$$

where:

$E_{fireBreaks}$	=	Annual GHG emissions from implementation of fire-preventing actions as REDD project activities. [$tCO_2e\ yr^{-1}$]
$nrFireClasses$	=	Number of forest strata in which fire breaks were installed. [-]
$area_{biomassLoss}(i)$	=	Total annual area of forest stratum i that was cleared for creating fire breaks. [$ha\ yr^{-1}$]
$C_{AGL}(i), C_{AGD}(i), C_{BG}(i)$	=	Carbon content in the aboveground live, aboveground dead, and belowground pools in forest stratum i. It is conservatively assumed that all biomass is removed. [$Mg\ C\ ha^{-1}\ yr^{-1}$].
$area_{fireBiomassLoss}(i)$	=	Annual area of forest stratum i that was cleared by prescribed burning. [$ha\ yr^{-1}$]
GWP_{CH4}	=	Global Warming Potential for CH_4 [-]
ER_{CH4}	=	Emission ratio for CH_4 (IPCC default value = 0.012). See Table 3A.1.15 in IPCC GPG-LULUCF (2003). [-]
$nrStrata$	=	Number of forest strata. [-]

$area_{biomassloss}(i)$: 5.85 ha

$area_{firebiomassloss}(i)$: 0.00 ha

$C_{AGL}(i)$: 138.84 tC/ha

$GHG_{firebreaks}$: 2978.12 tCO2e

DETERMINING LONG-TERM AVERAGE CARBON STOCK

$$LTAC_{harvest} = \frac{\sum_{t=0}^{T}\sum_{i=1}^{nrStrata} C_{harvest}(t,i)\cdot u_{inventory,harvest}(i)}{T} \quad \text{[EQ79]}$$

where:

$LTAC_{harvest}$	=	Long-term average Carbon stock density contained in harvested areas. [tCO_{2e} ha-1]
$nrStrata$	=	Number of forest strata. [-]
$C_{harvest}(t,i)$	=	Biomass carbon stock density at time t in stratum i in harvested areas. [tCO_2 ha^{-1}]
$u_{inventory,harvest}(i)$	=	Discounting factor for the uncertainty in biomass estimation in harvested areas in stratum i in harvest areas. The most recent $u_{inventory,harvest}(t,i)$ value must for used for discounting the estimate for future years. [-]
T	=	Minimal time period for estimating long term average. [yr].

T: 40 years

To estimate the $u_{inventory,\ harvest}(i)$, we need to develop EQ (17 – 22):

$$OM_o(i) = average\left(OM_{o,plot\text{-}wise}(i,p)\right) \quad \text{[EQ17]}$$

$$stdev\left(OM_o(i)\right) = stdev\left(OM_{o,plot\text{-}wise}(i,p)\right) \quad \text{[EQ18]}$$

$$stderr\left(OM_o(i)\right) = \frac{stdev\left(OM_o(i)\right)}{\sqrt{n_i}} \quad \text{[EQ19]}$$

$$HCWI\left(OM_o(i)\right) = t_{0.95,n-1} \cdot stderr\left(OM_o(i)\right) \quad \text{[EQ20]}$$

$$CE_{inventory}(i) = \frac{\sqrt{\sum_o HWCI\left(OM_o(i)\right)^2}}{\sum_o OM_o(i)} \quad \text{[EQ21]}$$

$$u_{inventory}(i) = \begin{cases} 1 & \text{if } CE(i) \leq 0.15, \\ 1 - CE(i) & \text{if } 0.15 < CE_{inventory}(i) < 1, \\ 0 & \text{if } CE(i) \geq 1 \end{cases} \quad \text{[EQ22]}$$

TABLE 89: STATISTICAL PARAMETERS OF AGB

Parameter	Average (t/ha)	Standard deviation	Sample size	Confidence Level	Degrees of freedom	Standard error	HCWI(OM)
AGB	295.41	11.02	119	95%	118	1.01020174	1.67478268

According to EQ21 $CE_{inventory}(i)$ is equal to 0.005, and according to EQ22, $u_{inventory,harvest}(i)$ is equal to 1.00.

To find the $C_{harvest}(t,i)$, we need to determine the following info:

- Average annual carbon density in harvested timber, equal to 0.31 tCO_2/ha

According to IPCC (2006), the net growth of aboveground biomass in tropical rainforest in South America for forests ≤ 20 years old is 11 t/ha/year and for forests ≥ years old is 3.1 t/ha/year, respectively. This growth, in tCO_2 is 20.67 and 5.68, respectively. Calculations are more detailed in "Net Carbon and VCU" Excel workbook, sheet "10".

TABLE 90: LONG-TERM AVERAGE CARBON STOCK DENSITY CONTAINED IN HARVESTED AREAS

LTAC$_{harvest}$: Long term average density in harvest zones. [tCO2e ha-1]	Year	$C_{harvest}(t,i)$: Carbon density in harvest zone by time and harvest area
727.98	2018.00	509.08
	2019.00	528.94
	2020.00	548.80
	2021.00	568.66
	2022.00	588.52
	2023.00	608.38
	2024.00	628.24
	2025.00	648.10
	2026.00	667.96
	2027.00	687.82

	2028.00	693.20

CALCULATE EMISSIONS OR SINKS ON LAND ON WHICH HARVESTING ACTIVITIES ARE IMPLEMENTED

$$\Delta C_{areaWithHarvest}(t) = \sum_{i=1}^{nrStrata} area_{projectAreaWithHarvest,projectScenario}(t,i) \cdot \left(\frac{C_{harvest}(t_2,i) - C_{harvest}(t_1,i)}{t_2 - t_1}\right) \cdot u_{inventory,harvest}(i) - \sum_{i=1}^{nrFNFtransitions} \sum_{tt=1}^{t} \left(\begin{array}{c} u_{classification} \cdot u_{transition}(i) \\ \cdot \Delta area_{projectAreaWithHarvet,baselineScenario}(t,i) \\ \cdot \left(EF_{AGL}(i) + EF_{AGD}(i,t-tt) + EF_{BG}(i,t-tt) + EF_{SOM}(i,t-tt)\right) \end{array} \right) - \sum_{i=1}^{nrStrataTransitions} \sum_{tt=1}^{t} \left(\begin{array}{c} u_{stratification} \cdot u_{transition}(i) \\ \cdot \Delta area_{projectAreaWitHarvest,baselineScenario}(t,i) \\ \cdot \left(EF_{AGL}(i) + EF_{AGD}(i,t-tt) + EF_{BG}(i,t-tt) + EF_{SOM}(i,t-tt)\right), \end{array} \right) \quad \text{[EQ80]}$$

Developed in section 3.2.4.

3.2.3 Leakage

TIME COST VALUES

The values of transportation cost (friction) to cross different land cover types were used.to prepare a cost map These values were obtained from the research “Conservation strategies through the Interoceanic Highway in Madre de Dios, Peru: an economic-spatial analysis” (Fleck et al, 2010).

TABLE 91: TIME COST VALUES

		1PIXEL=30m
Land use classes	**Cost - US$/ton/km**	**Cost - US$/ton/30m**
Paved Road	0.05	0.0015
Unpaved road	0.1	0.0030
Carriage way	0.2	0.0060
Path	0.3	0.0090
Forest extraction path	0.3	0.0090
Pastures	0.3	0.0090
Agricultural lands	0.3	0.0090
Tropical forests	3	0.0900

Peatlands	3	0.0900
Temperate forests	4	0.1200
Deserts and uncovered lands	4	0.1200
Water bodies	4	0.1200

* Values measured in amount of US$ required to transport a ton of product through a kilometer

To elaborate the cost-distance map (in time), we work with a 30-meters pixel and the maximum speed required by the main vehicle used for each land use class. With that information, we obtain the time (in hours) that it takes to the deforestation agent to cross a pixel of that land use class.

TABLE 92: SPEED PER LAND USE CLASS

	Source: Bozovich	**1PIXEL=30m**
Land use classes	**Maximum speed - km/h**	**T=E/V - (h)**
Paved Road	60	0.0005
Unpaved road	30	0.0010
Carriage way	20	0.0015
Path	10	0.0030
Forest extraction path	10	0.0030
Pastures	20	0.0015
Agricultural lands	20	0.0015
Tropical forests	5	0.0060
Peatlands	5	0.0060
Temperate forests	5	0.0060
Deserts and uncovered lands	5	0.0060
Water bodies	26	0.0012

Formula: Distance = Speed * Time.

In the whole Peruvian Amazon, the most common used vehicle is the motorcycle or the motorcar (motorcycles pulling a small cabinet with seats for 1-3 passengers and/or cargo), because of their accessibility to local population as it is cheap and easy to transport through rural and narrow routes. There are many motorcycles renting places. (Source: ESTUDIO DE DIAGNÓSTICO Y ZONIFICACIÓN DE LA PROVINCIA TAMBOPATA PARA EL TRATAMIENTO DE LA DEMARCACIÓN TERRITORIAL. VOLUMEN I. Puerto Maldonado, December, 2010. Available at:

http://www2.congreso.gob.pe/sicr/cendocbib/con4_uibd.nsf/007886A2CDEC740505257B7A0075FC13/%24FILE/doc_edz_tambopata.pdf).

According to VM0006-REDD-Mosaic-Methodology-v2.2, in section 8.3.2.2, a cost-distance map based on previous data for costs is elaborated.

Land use classes

- Paved Road

- Unpaved road
- Carriage way
- Path
- Forest extraction path
- Pastures
- Agricultural lands
- Tropical forests
- Peatlands
- Temperate forests
- Deserts and uncovered lands
- Water bodies

TABLE 94: TIME COST VALUES PER LAND USE CLASS

LAND USE CLASSES	TIME COST	HOURS
OTHER LANDS	0.006000	0.006
PEATLANDS	0.001154	0.001153846
FORESTLANDS	0.006000	0.006
AGRARIAN LANDS	0.001500	0.0015
PASTURELANDS	0.001500	0.0015
SETTLEMENTS	0.001500	0.0015
PAVED NATIONAL ROAD	0.000500	0.0005
UNPAVED REGIONAL ROAD	0.001000	0.001
UNPAVED LOCAL ROAD	0.001500	0.0015

These are the final values applicable to MINAM land use classes and will be converted to a raster for the leakage belt determination.

According to the methodology, the size and location of leakage belt must be determined using a GIS approach based on a transportation cost and social assessments. Following the methodology, we have built the leakage belt through 5 steps:

Step 1: We have defined the cost or friction to cross all the LULC classes existing in the landscape of project zone. To do that, we are working with the data from source: “Conservation strategies throughout the Interoceanic Highway in Madre de Dios, Peru: an economic-spatial analysis” (Fleck et al. 2010).

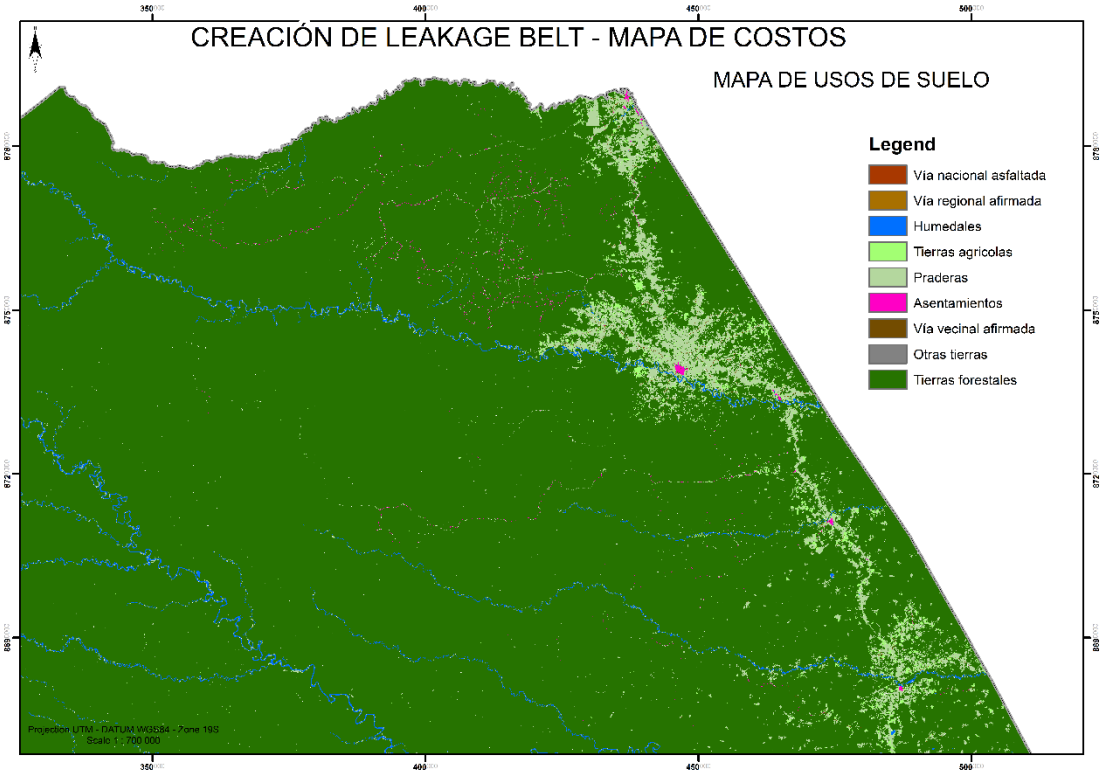
TABLE 95: TIME PER LAND USE CLASS

Land Use Class	Time (h)	Land Use Class	Time (h)
Other lands	0.006	Settlements	0.0015
Peatlands	0.00115	Paved national roads	0.0005
Forest lands	0.006	Unpaved regional roads	0.001

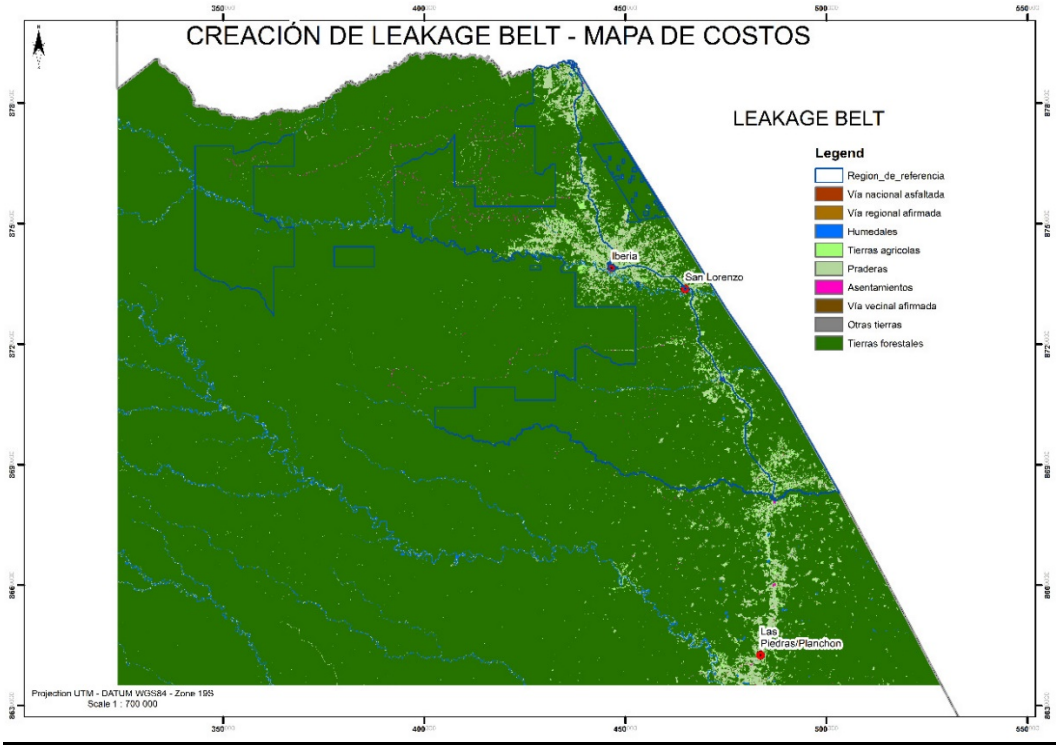
Agrarian lands	0.0015	Vecinal roads	0.0015
Pasture lands	0.0015		

Step 2: Based on those values, we generate a raster map of the reference region where each pixel contains the crossing cost of that pixel, as values obtained in table of Step 1.

MAP 33: COST MAP



MAP 34: MAP OF LAND USE CLASSES IN RR AND PA

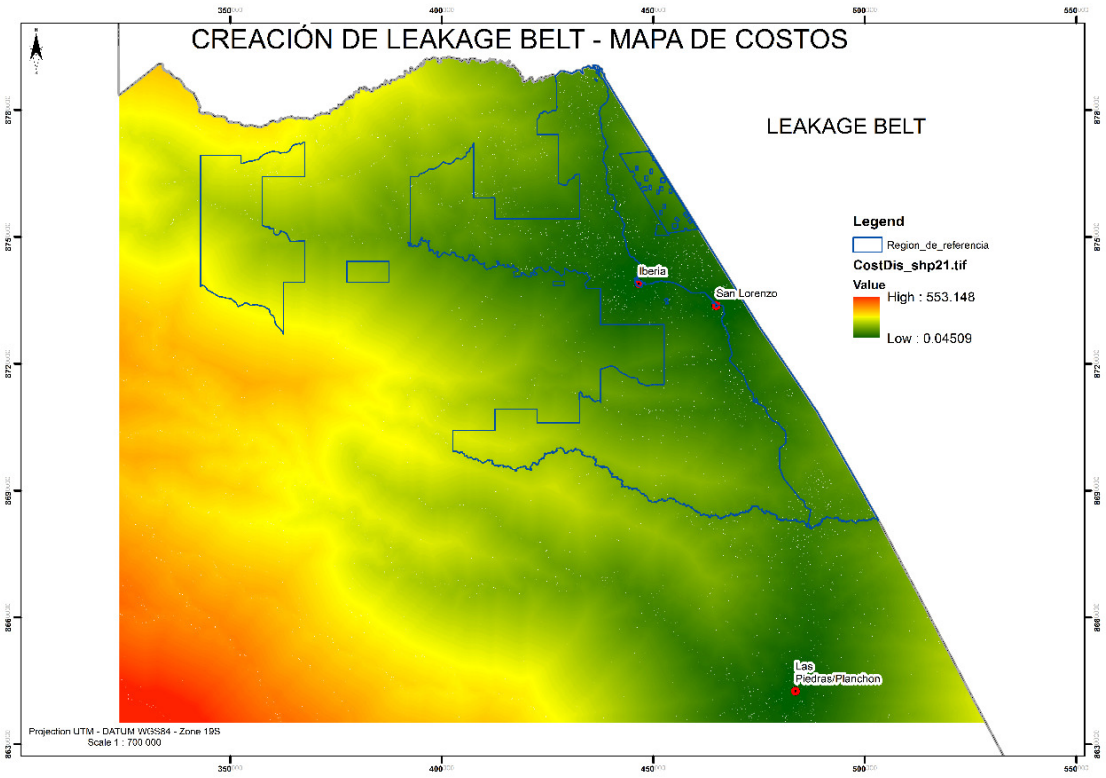


Step 3: From the cost-map, a new distance-cost map is produced with the cost measured in time taken to go from each pixel within the reference region to the closest pixel within the project area. To estimate that, we have summed the time taken to cross the intermediate pixels (going by the fastest route) between both points (the pixel in the RR and the closest pixel in the PA).

The values of the distance-cost map represent the cost (in time) to achieve from each pixel of the RR to the closest pixel in the PA by using the best transportation method.

It must be remembered that each pixel has a 30 meters of distance as it is based on LandSat images.

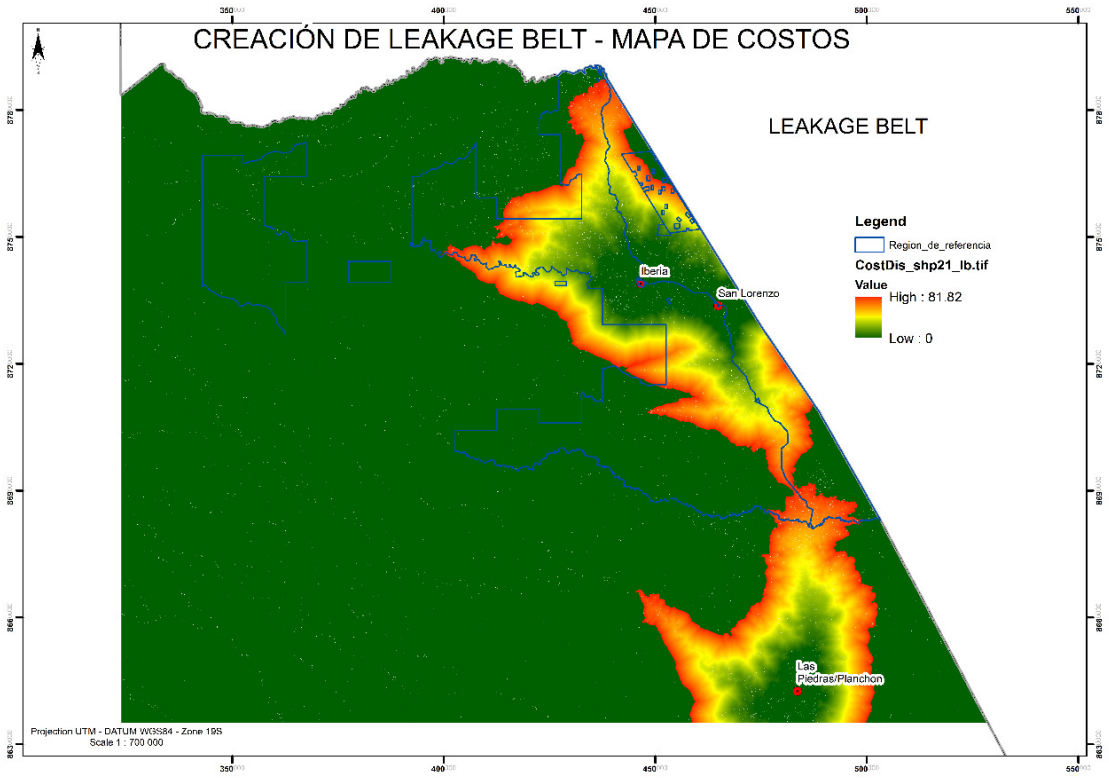
MAP 35: CREATION OF LEAKAGE BELT BASED ON COST MAP



Step 4: The next step is to determine the additional or extra time, each deforestation agent is willing to accept to continue doing its activity by displacing outside the project area in the surrounding forests. This was determined indirectly not asking them directly in order to not to create a wrong message that deforestation is permitted or promoted but instead analyzing in the project zone, specifically in the reference region, which is the most far away point where a deforested area for agrarian purposes is registered. The assumption is that if an agrarian production has occurred in this pixel, we can assume that it is profitable to establish some crops at this distance.

This is a conservative approach as likely, in the future, new roads will be opened and new cleared areas will reduce the transportation costs and farther forest areas could be profitable and attractive for deforestation agents.

MAP 36: LEAKAGE BELT



The farthest pixel found that is likely to be deforested for agrarian purposes has a value of 54.55. It means that it costs $ 54.55 to transport one ton per 0.03h, from this pixel to the nearest market, located in the city of Iberia. The farthest pixel was determined after a visual search of the location of non-forest pixels and selected the farthest one in a cluster of non-forest pixels. Maybe, there could be other non-forest pixels located in areas that are even farthest but they are isolated so likely they area associated with natural clearances of roads, not for productive purposes (agriculture or cattle ranching).

On the other side, the minimum cost is obtained from the pixel within the project area that has the lowest value in terms of distance-cost (time) to the closest market. In this case, the minimum value is 17,60 ($/ton/0,03h).

Step 5: According to the methodology, the maximum value is multiplied by 1,5 to estimate the maximum value of the leakage belt.

Values obtained are:

TABLE 96: VALUE ESTIMATED TO OBTAIN LEAKAGE BELT

Value	Parameter used	Factor applied	In the leakage Belt
Maximum (RR)	54,55	150%	81.82

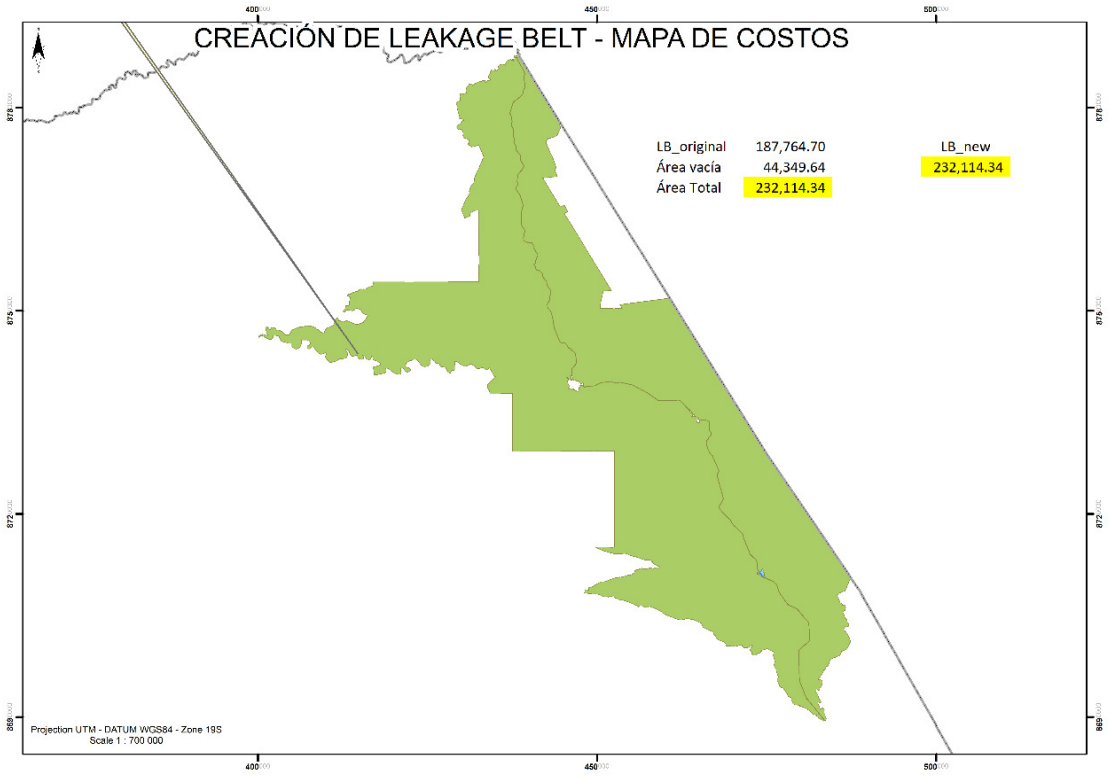
Areas closer to the market than the closest pixel within the project area do not belong to the leakage belt because it is not credible that if the agents of deforestation are able to deforest closer to the market, they would deforest within the project area (in the baseline scenario). For this reason, as the methodology does

not forbid the defiintion of a minimum value, we had used the pixel of the project area that has the lowest distance-cost to the market as the benchmark to define the minimum value of the leakage belt. As stated, this is not in contradiction with the methodology because the methodology does not establish anything about it. In spite of this, we have added to the leakage belt (the former white) areas with the distance cost value (close to the markets) below the minimum distance cost value recorded within the project area. From our understanding, there is no way that the deforestation, in this area, would occur as a consequence of the displacement of avoided deforestation within the project area (the definition of leakage). The profitability in this area, closer to the market, is higher than in the project area so, if the drivers have the opportunity to settle here (in the former white areas), they will prefer to do it instead of going to the project area. For this reason, if drivers are being displaced from the project area, it means that they weren't allowed to settle in this (former white) area for another reason whatsoever.

But in any case, as the auditors request that all values below the maximum willingness to displace should be part of the leakage belt, we have included them, clarifying that this goes beyond the concept of leakage.

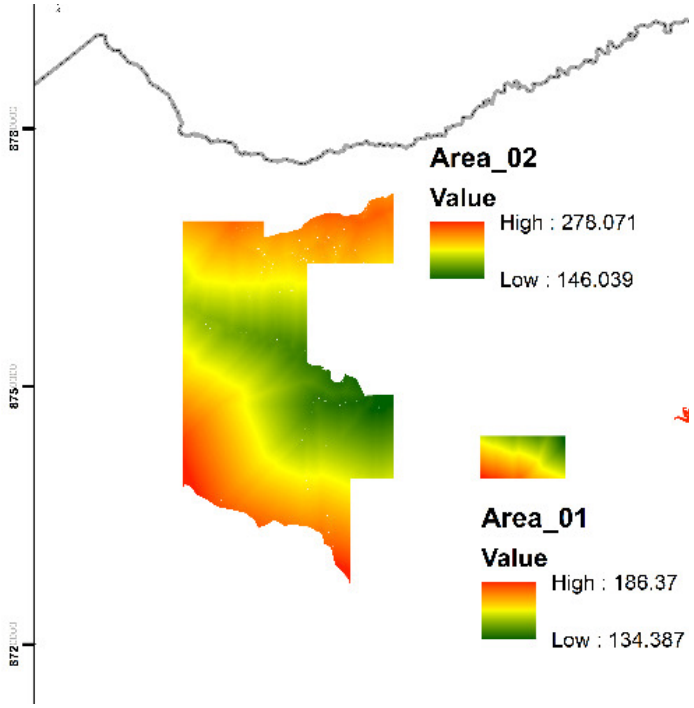
Step 6: With those values, we can determine the size and location of the leakage belt that, according to the methodology, must be encompassed by the reference region and, if necessary, may expand the size of reference region. In this case, it has not been necessary. The figure of the leakage belt is presented in the following map, encompassed by the reference region, and combining forest and non-forest areas, as required by the methodology:

MAP 37: LEAKAGE BELT AREA



The leakage belt is obtained by cutting the area, within the RR, that contains the pixels that are within the range of values of distance-cost indicated previously.

MAP 38: TRANSPORTATION COST IN REFERENCE REGION



As may be noted, two polygons that are part of the reference region have not been included in the following maps. The reason is that the minimum values of each one of those two polygons are higher than 81.82, the maximum value, allowed to be included in the leakage belt. The small polygons within the conservation concession administered by Conservation International (the white area in the north –east) are not part of the leakage belt because these areas are inaccessible. To go there, deforestation agents would need to cross the borders of the conservation concession, which at this point should be considered impossible.

NOTE: Estimations of quantifications in this section are preliminary and subject to confirmation during first verification stage due to methodology deviation No. 3 described in section 3.1.6.

TABLE 97: Significance Test of GHG Emissions

Year	L(1): Conversion of forestlands to croplands	L(2): Conversion of forestlands to pastures	L (3): Conversion of forestlands to settlement	L (10b) Forest Fire
2018	453041.6998	564187.7276	430154.7432	0.00
2019	526689.0203	655903.1578	500081.5165	35.20
2020	609946.2066	759586.07	579132.6803	0.00

			2018	2019	2020
L (1)	RC_{Ei}	Relative contribution of each source I to the total GHG emissions within project area and leakage belt	0.31	0.31	0.31
L (2)			0.39	0.39	0.39
L (3)			0.30	0.30	0.30

L (10b)			0.00	0.00	0.00

					Accumulated
RC_{Ei}	Relative contribution of each source I to the total GHG emissions within project area and leakage belt	4	L (2)	0.39	0.39
		3	L (1)	0.31	0.70
		2	L (3)	0.30	1.00
		1	L (10b)	0.00	

The sum of increases in emissions that may be excluded must be less than 5% of the emission reductions. If it is determined that a specific GHG emission source will never reach this threshold and will never become significant, it may be omitted from the monitoring plan. Therefore, the Forest fire driver may be omitted from the monitoring plan.

Regarding Leakage Cancellation factors, the main assumptions used these values for each driver was obtained from the level of involvement with the project of each agent and the size and productive activities that are present in each community.

Even though migration is a common practice in the surrounding area, the pattern how it occurs is that families, settled previously in the existing communities, invite their relatives to come and establish in their communities, expanding the size of the community land around their original lands. For this reason, the pattern of migration does not imply a creation of new settlements as this is more difficult to be authorized. Consequently, geographically unconstrained leakage is not applicable.

Summarizing:

TABLE 98: LEVEL OF ENGAGEMENT PER COMMUNITY AND MAIN ACTIVITIES

Community	Level of Engagement	Families	Hectares	Cropland	Grazing	Logging
Carachamayoc	100%	103	6,000	●		●
Portillo	100%	60	4,000	●	●	●
San Francisco	100%	38	1,140	●		
Arca Pacahuara	0%	596	6,000	●		

The assumptions are:

- Carachamayoc, Portillo and San Francisco are 100% involved with the project so the productive activities that will be supported by the REDD+ project (that will increase their agrarian production and incomes in 10 times compared to current level of subsistence) will imply that they do not need to expand new forest areas producing a displacement or leakage of deforestation.

- Arca Pacahuara, on the other hand, is 0% involved with the project. So, even with the real benefits of project activities, they will continue applying their traditional beliefs and expanding their agrarian frontier. The only action that may slow that expansion is the Master Plan of Permanent Production Forests (PM-BPP) for the province of Tahuamanu, currently under design and promoted by SERFOR. See more details in Annex 13. Specifically, the PM-BPP proposes 4 key axes: 1) Strengthened Institutional Governance: 2) Private Sector Engagement; 3) Forest Sustainable Management; 4) Fight and reduction of illegal activities within the forests. Regarding the fourth component, it includes a joint intervention with Attorney, Police and Municipalities to avoid new land invasions caused by migrants. We will assume that these combined actions will reduce the expansion interest of Arca Pacahuara from 100% to 50%.
- According to what may be reviewed in more detail in community section of current PD, Grazing is only present in one community (Portillo), while domestic timber is present in two communities (Carachamayoc and Portillo). Finally, lands for crops is present in the 4 communities.
- To estimate the leakage factor cancellation, we will assume that no expansion is allowed but there is a risk that, in the case of Arca Pacahuara, it will occur in the project scenario in the case of croplands at a rate of 50%. Δ Area allowed = 0.
- To estimate the percentage of impact in the whole cropland leakage cancellation factor of this null level of engagement, we must multiply by the weight of Arca Pacahuara, compared to the other communities. This is conservative because Arca Pacahuara has many more families, communal area and productive surface. As an example, Arca Pacahuara covers currently 6,000 ha while the four communities sum 17,140 ha. So Arca Pacahuara weights 35% (6,000 ha/17,140 ha).

Summarizing:

TABLE 99: WEIGHT OF EACH COMMUNITY IN TERMS OF AREA

Community	**Weight (communal area / total neighboring area)**	
Carachamayoc	6,000/17,140	35%
Portillo	4,000/17,140	23%
San Francisco	1,140/17,140	7%
Arca Pacahuara	6,000/17,140	35%

Based on those assumptions, we have calculated the Δ(Area) in project scenario, for each driver of deforestation:

TABLE 100: LEAKAGE FACTOR CANCELLATION - CROPLAND

Community \Code	**Participation** **P**	**Weight** **W**	**Level of Engagement** **LE**	**discount factor thanks to PM-BPP** **DF**	**Final rate** If P = Yes, W * (1-LE) * DF If P= No, 0
Carachamayoc	Yes	35%	100%	N.A.	0%
Portillo	Yes	23%	100%	N.A.	0%
San Francisco	Yes	7%	100%	N.A.	0%
Arca Pacahuara	Yes	35%	0%	50%	17.5%

The sum is 17.5% which must be multiplied by the area expected to be changed in the baseline scenario to estimate the Δ(Area) in project scenario for cropland.

Grazing (applying the same formulae than cropland because, in the methodology, grazing is within the forest causing mostly degradation at 95%, while in the project zone, grazing cause deforestation)

TABLE 101: LEAKAGE FACTOR CANCELLATION – PASTURES

Community \Code	Participation P	Weight W	Level of Engagement LE	discount factor thanks to PM-BPP DF	Final rate If P = Yes, W * (1-LE) * DF If P= No, 0
Carachamayoc	Yes	35%	100%	N.A.	0%
Portillo	Yes	23%	100%	N.A.	0%
San Francisco	No	7%	100%	N.A.	0%
Arca Pacahuara	No	35%	0%	50%	0%

The sum is 0% which must be multiplied by the area expected to be changed in the baseline scenario to estimate the Δ(Area) in project scenario for pastures.

Domestic Timber

Only Portillo and Carachamayoc extract timber for domestic uses and both communities are engaged with the project so the risk of leakage will be assumed 0.

Infrastructure

No projections of new roads have been used to project changes in the baseline scenario to calculate the forest loss area so the value is 0.

Forest fires

Forest fires caused by rural producers may be controlled through training in fire management in the short term. In the mid and long-term, the risk may be minimized significantly by implementing agroforestry projects that promote a more efficient use of soils.

Under these conditions, the rural producers themselves will be the main interested in avoiding use of fire considering that if they do that, they will put under risk their valuable plantations. In addition, the Master Plan of BPP has as one of its axes, the prevention of conflicts and an enhanced governance of the territory.

Summarizing:

TABLE 102: LEAKAGE FACTOR CANCELLATION – ALL THE DRIVERS

	Rate		Rate		Rate
Cropland	17.5%	Understory vegetation	N.A.	Fuel Wood	N.A.
Settlement	N.A.	Domestic Timber	0	Forest fires	10%
Infrastructure	N.A.	Grazing	0		

Leakage belt: 187,764.7 ha.

The leakage cancelation rate to avoid deforestation caused by conversion of forest lands in croplands was obtained from EQ85.

$$leakage_{constrained}(cropland\ conversion\ by\ participating\ communities) = \frac{\Delta area_{cropLand,project} - \Delta area_{cropLand,allowed}}{\Delta area_{cropLand,baseline} - \Delta area_{cropLand,allowed}} \quad \text{[EQ85]}$$

Where:

$leakage(cropland\ conversion)$	=	Leakage cancellation rate for avoiding deforestation/degradation due to conversion of forest land to settlements. [-]
$\Delta area_{cropLand,baseline}$	=	Area that would be converted to cropland by participating communities under the baseline scenario. [ha yr^{-1}]
$\Delta area_{cropLand,project}$	=	Area that will be converted to cropland by participating communities under the project scenario after reduction in demand for cropland conversion. [ha yr^{-1}]
$\Delta area_{cropLand,allowed}$	=	Area that will be converted to cropland within the project area under the project scenario as defined in the management plan or project document. [ha yr^{-1}]

With the $\Delta area_{(cropland,baseline)}$ in table 74, $\Delta area_{(cropland,project)}$ in table 77 and $\Delta area_{(cropland,allowed)}$ as 0, we obtain the leakage cancellation rate ($Leakage_{(cropland\ conversion)}$) valued in 0.18.

The total relative impact of leakage in reduction of GHG emissions due to project activities ($RelativeLeakageImpact_{DF}(t)$), according to EQ83 is obtained multiplying the leakage cancellation rate with the relative driver impact. In this case, we obtain a value of 0.24

$$RelativeLeakageImpact_{DF}(t) = \sum_{d=1}^{nrCDrivers} leakage_{constrained}(d) \cdot RelativeDriverImpact_{DF}(t,d) \quad \text{[EQ83]}$$

With these data, we obtain the induced increase in leakage from deforestation rate in leakage area (EQ95 and EQ97).

$$D_{leakageArea,baselineScenario,DF}(t) = D_{projectArea,baselineScenario,DF}(t)\frac{size_{leakageArea}}{size_{projectArea}} \quad \text{[EQ95]}$$

$$D_{leakageArea,projectScenario,DF}(t) = \Delta D_{LK,DF}(t) + D_{leakageArea,baselineScenario,DF}(t) \quad \text{[EQ97]}$$

TABLE 103: DEFORESTATION RATE IN LEAKAGE AREA

Carbon emissions from deforestation in leakage area during year t (tCO2e/year)	$D_{leakageArea,projectScenario,DF}^{(t)}$: Deforestation rate in leakage area under the project scenario in time t of crediting period [ha/year]	$D_{leakageArea,baselinetScenario,DF}^{(t)}$ Reference deforestation rate in leakage area at time t of crediting period (ha/year)	$\Delta D_{LK,DF}$: Induced increasing deforestation rates by leakage during year t of crediting period (ha/year)
-1,618,602.69	3,212.79	2,707.67	505.12
-1,864,589.90	3,701.05	3,119.17	581.89
-2,142,125.16	4,251.94	3,583.44	668.50
-2,436,598.83	4,836.44	4,103.76	732.68
-2,780,081.03	5,518.22	4,682.26	835.96
-3,158,310.88	6,268.98	5,319.28	949.69
-3,569,984.90	7,086.12	6,012.63	1073.48
-4,011,740.28	7,962.96	6,756.64	1206.32
-4,477,531.46	8,887.52	7,541.14	1346.38
-4,957,972.06	9,841.15	8,350.30	1490.85

3.2.4 Net GHG Emission Reductions and Removals

NOTE: Estimations of quantifications in this section are preliminary and subject to confirmation during first verification stage due to methodology deviation No. 3 described in section 3.1.6.

EQ105 of the methodology was used to estimate NER for the whole crediting period of the project.

TABLE 104: SOURCES OF EMISSIONS

Net Emission Reductions(NERs)	=
ΔGHG from avoided deforestation excluding ANR and harvest areas	01 +
+ ΔGHG from deforestation due to leakage	02 +
+ ΔGHG from avoided degradation	03 +
+ ΔGHG from degradation due to leakage	04 +
+ΔGHG from leakage by unconstrained geographic drivers	05 +
+ ΔGHG from assisted natural regeneration	06 +
+ ΔGHG from changes in long-lived wood products	07 +
+ ΔGHG from improved cook stoves	08 +
+ ΔGHG from other and secondary sources	09 +
+ΔGHG from avoided deforestation from areas under harvest	10

ΔGHG from avoided deforestation:

$$❶ = \sum_{i=1}^{nrFNFtransitions} \sum_{tt=1}^{t} u_{classification} \cdot u_{transition}(i) \cdot \left(\begin{matrix} +\Delta area_{projectAreaEAH,projectScenario}(t,i) \\ -\Delta area_{projectAreaEAH,baselineScenario}(t,i) \end{matrix} \right) \cdot \left(EF_{AGL}(i) + EF_{AGD}(i, t-tt) + EF_{BG}(i, t-tt) + EF_{SOM}(i, t-tt) \right) \quad \text{[EQ107]}$$

Uclassification was used in table 62 while Utransition from table 69 and emission factors from table 68 for all equations. The $\Delta area_{projectAreaEAH,projectScenario}(t,i)$ and $\Delta area_{projectAreaEAH,projectScenario}(t,i)$ is the transition area, excluding harvest area in the project scenario and baseline scenario, respectively.

$\Delta area_{projectAreaEAH,projectScenario}(t,i)$: (Project Area – harvest area)/Project Area * deforestation rate in Project area in baseline scenario)

$\Delta area_{projectAreaEAH,projectScenario}(t,i)$: (Project Area – harvest area)/Project Area * deforestation rate in Project area in baseline scenario)

TABLE 105: ΔGHG FROM AVOIDED DEFORESTATION EXCLUDING ANR AND HARVEST AREAS.

Year	1	Hectares in transition within project zone, excluding RNA and harvest areas, under project scenario during year t	Hectares in transition within project zone, excluding RNA and harvest areas, under baseline scenario during year t
2018	1,320,722.29	-713.09	2075.76
2019	1,521,439.12	-821.46	2391.23
2020	1,747,898.02	-943.73	2747.15
2021	1,917,247.46	-902.44	3146.04
2022	2,187,517.79	-1029.65	3589.54

2023	2,483,844.57	-1169.74	4075.18
2024	2,807,604.43	-1322.21	4606.36
2025	3,155,021.69	-1485.82	5176.36
2026	3,521,341.83	-1658.33	5777.37
2027	3,899,182.97	-1836.27	6397.29

ΔGHG from deforestation due to leakage:

$$❷ = \sum_{i=1}^{nrFNFtransitions} \sum_{tt=1}^{t} u_{classification} \cdot u_{transition}(i) \cdot \left(\begin{matrix} +\Delta area_{leakageArea,projectScenario}(t,i) \\ -\Delta area_{leakageArea,baselineScenario}(t,i) \end{matrix} \right) \cdot \left(EF_{AGL}(i) + EF_{AGD}(i, t-tt) + EF_{BG}(i, t-tt) + EF_{SOM}(i, t-tt) \right) \quad \text{[EQ108]}$$

$\Delta area_{leakageArea,projectScenario,DF}^{(t)}$: Hectares undergoing transition ii within the leakage area under the project scenario during year tt. [ha yr-1].

$\Delta area_{leakageArea,baselineScenario,DF}^{(t)}$: Hectares undergoing transition ii within the leakage area under the baseline scenario during year tt. [ha yr-1].

In both cases, transition area is 100% of deforestation rate in the leakage area in both scenarios.

TABLE 106: + ΔGHG FROM DEFORESTATION DUE TO LEAKAGE

Year	2	$\Delta area_{leakageArea,projectScenario,DF}^{(t)}$	$\Delta area_{leakageArea,baselineScenario,DF}^{(t)}$
2018	-252,953.07	3212.79	2707.67
2019	-291,395.63	3701.05	3119.17
2020	-334,768.47	4251.94	3583.44
2021	-366,908.40	4836.44	4103.76
2022	-418,630.71	5518.22	4682.26
2023	-475,585.39	6268.98	5319.28
2024	-537,576.17	7086.12	6012.63
2025	-604,096.67	7962.96	6756.64
2026	-674,236.52	8887.52	7541.14
2027	-746,582.32	9841.15	8350.30

ΔGHG from avoided degradation:

$$❸ = \sum_{i=1}^{nrStrataTransitions} \sum_{tt=1}^{t} u_{stratification} \cdot u_{transition}(i) \cdot \left(\frac{+\Delta area_{projectAreaEAH,projectScenario}(t,i)}{-\Delta area_{projectAreaEAH,baselineScenario}(t,i)} \right) \cdot \left(EF_{AGL}(i) + EF_{AGD}(i,t-tt) + EF_{BG}(i,t-tt) + EF_{SOM}(i,t-tt) \right) \quad \text{[EQ109]}$$

It is equivalent to 0.00.

ΔGHG from degradation due to leakage: [EQ110]

$$❹ = \sum_{i=1}^{nrStrataTransitions} \sum_{tt=1}^{t} u_{stratification} \cdot u_{transition}(i) \cdot \left(\frac{+\Delta area_{leakageArea,projectScenario}(t,i)}{-\Delta area_{leakageArea,baselineScenario}(t,i)} \right) \cdot \left(EF_{AGL}(i) + EF_{AGD}(i,t-tt) + EF_{BG}(i,t-tt) + EF_{SOM}(i,t-tt) \right)$$

It is equivalent to 0.00.

ΔGHG from leakage by unconstrained geographic drivers:

$$❺ = - GHG_{otherLeakageSources}(t) - GHG_{marketLeakage}(t) \quad \text{[EQ111]}$$

It is equivalent to 0.00.

ΔGHG from assisted natural regeneration:

$$❻ = C_{ANR}(t) \quad \text{[EQ112]}$$

It equals to 0.00.

ΔGHG from changes in long-lived wood products:

$$❼ = \frac{44}{12} \cdot \left(C_{LWP,project}(t) - C_{LWP,baseline}(t) \right) \quad \text{[EQ113]}$$

$C_{LWP,project}(t)$: Carbon stock in long-lived wood products under the baseline scenario during year *t* [Mg C]

$C_{LWP,baseline}(t)$: Carbon stock in long-lived wood products under the project scenario during year *t* [Mg C]

$$C_{LWP,project}(t) = \sum_{s,wp,ppb,oir}^{ty} C_{HWP,project}(ty,t) \cdot \left(1 - wwf(ty)\right)\left(1 - slp(ty)\right)\left(1 - fo(ty)\right)$$

$$C_{LWP,baseline}(t) = \sum_{s,wp,ppb,oir}^{ty} C_{HWP,baseline}(ty,t) \cdot \left(1 - wwf(ty)\right)\left(1 - slp(ty)\right)\left(1 - fo(ty)\right)$$

[EQ103]

wwf (ty): Fraction of carbon in harvested wood products that is emitted immediately because of mill inefficiency for wood class, 24%.

slp (ty): Proportion of short lived products, 0.2.

fo (ty): Fraction of carbon that will be emitted to the atmosphere between 5 and 100 years of harvest for wood class, 0.85.

$$C_{HWP,project}(ty,t) = \sum_{h=1}^{H_{PS}} \sum_{j=1}^{S_{PS}} \left(\left(DT_{project}(h,j,ty,t) + CT_{project}(h,j,ty,t) \right) \cdot \rho_{wood,J} \cdot CF \right)$$

[EQ102]

$$C_{HWP,baseline}(ty,t) = \sum_{h=1}^{H_{PS}} \sum_{j=1}^{S_{PS}} \left(\left(DT_{baseline}(h,j,ty,t) + CT_{baseline}(h,j,ty,t) \right) \cdot \rho_{wood,J} \cdot CF \right)$$

where:

$C_{HWP,project}(ty,t)$ and $C_{HWP,baseline}(ty,t)$	=	Total carbon stock in long-lived wood products within the project boundary for class ty during time t of wood product ty in the project and baseline scenario, respectively [Mg C]
$DT_{project}(h,j,ty,t)$, $DT_{baseline}(h,j,ty,t)$, $CT_{project}(h,j,ty,t)$ $CT_{baseline}(h,j,ty,t)$	=	The volume of timber extracted from within the project boundary during harvest h by species j and wood product class ty during year t in the project and baseline scenario, respectively. DT = domestic timber; CT = commercial timber [m^3].
$\rho_{wood,j}$	=	Wood density of harvested species or species group j [Mg DM m^{-3}]
h	=	1, 2, 3, …, H_{PS} number of harvests [-]
j	=	1, 2, 3, …, S_{PS} harvested tree species [-]
ty	=	Wood product class – defined here as sawn wood (sw), wood-based panels (wp), other industrial round wood (oir), and paper and paper board (ppb).
CF	=	Carbon fraction of wood [Mg C (Mg DM)$^{-1}$] (default value = 0.5)

$DT_{project}$ y $DT_{baseline}$ are equal to 0.00.

For $CT_{baseline}$, it was used the unauthorized timber volume for Tahuamanu is 10,086.120 m^3 for the years 2012 – 2016 (OSINFOR 2018[31]) multiplied by the proportion represented by the project area as the share of Tahuamanu area (0.1), obtaining 1008.61 m^3, then it was divided between the 4 years, resulting in an average of 252.15 m^3 per year.

$C_{HWP,baseline}$ (ty,t) was obtained multiplying $CT_{baseline}$ with CF and the average of timber species densities, that were harvested in the Project scenario in year 2018.

TABLE 107: CARBON CONTENT IN HARVESTED WOOD PRODUCTS IN PROJECT AREA (2018)

$C_{HWP,project}$(ty,t) Total carbon content in harvested wood products within project boundaries [Mg C]	$CT_{Project}$: Volume of annual harvested wood, round wood for commercial sales [m3/year]	Scientific Name	Basic density per specie, using Table GPG-LULUCF 3A.1.9. [Mg.dm/m3]
969.171	2,769.060	*Apuleia leiocarpa*	0.7
580.91675	1,873.925	*Hymenaea oblongifolia*	0.62

31 https://www.osinfor.gob.pe/wp-content/uploads/2018/07/APROVECHAMIENTO-FORESTAL-CASTA%C3%91A-VF.pdf

1232.42391	4,564.533	*Couratari guianensis*	0.54
175.51044	835.764	*Cedrela odorata*	0.42
243.4263	624.170	*Myroxylon balsamum*	0.78
120.862895	562.153	*Amburana cearensis*	0.43
908.17697	3,078.566	*Clarisia racemosa*	0.59
5.0565	13.484	*Aspidosperma macrocarpon*	0.75
556.1127	1,278.420	*Manilkara bidentata*	0.87
2627.92425	5,651.450	*Dipteryx odorata*	0.93
292.21086	635.241	*Tabebuia serratifolia*	0.92
863.780	3839.023	*Cedrelinga catenaeformis*	0.45

$C_{LWP,baseline}$ is obtained by using the equation EQ103 and value obtained is 30.66 [Mg C] in 2018. $C_{LWP,project}$ is also obtained with EQ103, and results are shown in Table 94.

TABLE 108: NET VARIATION OF EXISTENCES IN 2018

Net variations of carbon content in long-term wood products during year t [Mg CO2]	Carbon in long-term wood products within project scenario. [Mg C]
211.66	88.39
194.26	52.98
412.12	112.40
58.69	16.01
81.40	22.20
40.42	11.02
303.69	82.83
1.69	0.46
185.96	50.72
878.78	239.67
97.72	26.65
288.85	78.78

The total net variation of carbon content in long-term wood products in 2018 is 2755.24 Mg CO2. This value was used as reference for years 2019-2027.

TABLE 109: ΔGHG FROM CHANGES IN LONG-LIVED WOOD PRODUCTS tCO_2

Year	**7**
2018	2,839.56

2019	2,839.56
2020	2,839.56
2021	2,839.56
2022	2,839.56
2023	2,839.56
2024	2,839.56
2025	2,839.56
2026	2,839.56
2027	2,839.56

ΔGHG from GHG Emissions Reduction from Cookstove and Fuel Efficiency (CFE):

$$❽ = ER_{CFE}(t) \quad \text{[EQ114]}$$

It is 0.00.

ΔGHG from other and secondary sources:

$$❾ = -GHG_{fireBreaks}(t) - GHG_{sources,leakagePrevention}(t) - GHG_{sources,ANR}(t) \quad \text{[EQ115]}$$

$area_{biomassloss}(i)$: Total annual area in forest stratum ii that was cleared for firebreaks (ha/year) only for year 2019 was accounted as 5.85 ha.

According to EQ115, **❾** = -2978.118 tCO_2

ΔGHG from avoided deforestation and degradation from areas under harvest [EQ116]

In case:

$$\sum_{i}^{t} \Delta C_{areaWithHarvest}(i) \geq \sum_{i=1}^{nrStrata} area_{projectAreaWithHarvest,projectScenario}(t,i) \cdot LTAC_{Harvest}$$

$$❿ = 0$$

$$\Delta C_{areaWithHarvest}(t) = \qquad \text{[EQ80]}$$

$$\sum_{i=1}^{nrStrata} area_{projectAreaWithHarvest,projectScenario}(t,i) \cdot \left(\frac{C_{harvest}(t_2,i) - C_{harvest}(t_1,i)}{t_2 - t_1}\right) \cdot u_{inventory,harvest}(i)$$

$$- \sum_{i=1}^{nrFNFtransitions} \sum_{tt=1}^{t} \left(\begin{array}{c} u_{classification} \cdot u_{transition}(i) \\ \cdot \Delta area_{projectAreaWithHarvet,baselineScenario}(t,i) \\ \cdot \left(EF_{AGL}(i) + EF_{AGD}(i,t-tt) + EF_{BG}(i,t-tt) + EF_{SOM}(i,t-tt)\right) \end{array} \right)$$

$$- \sum_{i=1}^{nrStrataTransitions} \sum_{tt=1}^{t} \left(\begin{array}{c} u_{stratification} \cdot u_{transition}(i) \\ \cdot \Delta area_{projectAreaWitHarvest,baselineScenario}(t,i) \\ \cdot \left(EF_{AGL}(i) + EF_{AGD}(i,t-tt) + EF_{BG}(i,t-tt) + EF_{SOM}(i,t-tt)\right) \end{array} \right)$$

$area_{projectAreaWithHarvest,projectScenario}(t,i)$: Hectares in transition ii within project area in harvest zone, in project scenario in 2018, 9352.187 ha will be used as reference for coming years.

$area_{projectAreaWithHarvest,baselineScenario}(t,i)$: Hectares in transition ii within project area in harvest zone, in baseline scenario was obtained as (proportion of harvest area of total project area) * deforestation rate in project.

TABLE 110: TRANSITION AREAS IN HARVEST ZONE IN PROJECT AREA

Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
$area_{projectAreaWithHarvest,baselineScenario}(t,i)$: Hectares in transition ii in harvest area in baseline scenario in year t	59.15	68.14	78.28	89.65	102.29	118.92	134.42	151.05	168.59	186.68

$u_{stratification}$ is equivalent to 0.75 and $u_{inventory,harvest}(i)$ to 1.

According to EQ80, $\Delta C_{areaWithHarvest}(t)$ for every year is:

TABLE 111: Carbon density in harvest zones in stratum ii in year t

Year	**10**: [tCO2 ha-1]
2018	235,142.31
2019	242,651.02
2020	251,122.73
2021	260,617.24
2022	271,173.27
2023	285,063.38
2024	298,010.49
2025	311,903.66
2026	326,552.75
2027	206,211.73

$$LTAC_{harvest} = \frac{\sum_{t=0}^{T}\sum_{i=1}^{nrStrata} C_{harvest}(t,i)\cdot u_{inventory,harvest}(i)}{T} \quad \text{[EQ79]}$$

With project crediting period (T) of 40 years, the LTACharvest is 727.98 tCO2e ha-1.

For this reason, according to EQ80, as $area_{projectAreaWithHarvest,projectScenario}(t,i)$ * $LTAC_{harvest,}$ is greater than $\Delta C_{areaWithHarvest}(t)$, ΔGHG from avoided deforestation from areas under harvest (**10**) is equal to $\Delta C_{areaWithHarvest}(t)$.

TABLE 112: NET GHG EMISSIONS REDUCTIONS tCO_2

Year	(NERs)	1	2	7	9	10
2018	1,314,144.03	1,331,103.51	-254,941.35	2,839.56	0.00	235,142.31
2019	1,482,224.42	1,533,398.03	-293,686.08	2,839.56	-2,978.12	242,651.02
2020	1,678,199.42	1,761,636.96	-337,399.84	2,839.56	0.00	251,122.73
2021	1,825,981.93	1,932,317.53	-369,792.40	2,839.56	0.00	260,617.24
2022	2,056,803.83	2,204,712.26	-421,921.26	2,839.56	0.00	271,173.27
2023	2,311,947.57	2,503,368.24	-479,323.62	2,839.56	0.00	285,063.38
2024	2,588,721.33	2,829,672.94	-541,801.66	2,839.56	0.00	298,010.49
2025	2,885,719.19	3,179,820.99	-608,845.02	2,839.56	0.00	311,903.66
2026	3,198,876.62	3,549,020.50	-679,536.20	2,839.56	0.00	326,552.75
2027	3,386,432.20	3,929,831.56	-752,450.66	2,839.56	0.00	206,211.73

Summarizing:

TABLE 113

Year	Estimated baseline emissions or removals (tCO2e)	Estimated project emissions or removals (tCO2e)	Estimated leakage emissions (tCO2e)	Estimated net GHG emission reduction or removals (tCO2e)
2018	-1,040,157.83	2,609,243.21	-254,941.35	1,314,144.03
2019	-1,198,235.87	2,974,146.36	-293,686.08	1,482,224.42
2020	-1,376,587.52	3,392,186.78	-337,399.84	1,678,199.42
2021	-1,576,471.81	3,772,246.14	-369,792.40	1,825,981.93
2022	-1,798,703.72	4,277,428.81	-421,921.26	2,056,803.83
2023	-2,044,388.48	4,835,659.66	-479,323.62	2,311,947.57
2024	-2,310,866.87	5,441,389.87	-541,801.66	2,588,721.33
2025	-2,596,817.07	6,091,381.28	-608,845.02	2,885,719.19
2026	-2,898,325.74	6,776,738.56	-679,536.20	3,198,876.62
2027	-3,209,317.04	7,348,199.90	-752,450.66	3,386,432.20
Total	-20,049,871.95	47,518,620.57	-4,739,698.09	22,729,050.54

3.3 Monitoring

3.3.1 Data and Parameters Available at Validation

NOTE: Estimations in this section are preliminary and subject to confirmation during first verification stage.

Data/parameter [EA1]:	CF
Data unit:	Mg C (Mg DM)$^{-1}$
Description:	Carbon fraction of dry matter in wood
Sources of data:	Default value of 0.5
Value applied:	0.50 (Tropical region; wood, tree d ≥ 10 cm)
Justification of choice of data or description of measurement methods and procedures applied:	According to the IPCC, the default value for tropical region is 0.49 Mg C (Mg DM)$^{-1}$ is applicable for wood, tree with d ≥ 10 cm all three tiers when remaining forest land, forest land or biomass carbon.
Purpose of data:	Calculation of baseline emissions, Calculation of project emissions; Determination of baseline scenario, Calculation of leakage
Comments:	1 Mg C (Mg DM)$^{-1}$ <> 1 t C (t DM)$^{-1}$

Data/parameter [EA6]:	sc_1
Data unit:	[-]
Description:	First shape factor for the forest scarcity equation; steepness of the decrease in deforestation rate (greater is steeper).
Sources of data:	
Value applied:	Not applicable as the % of remnant forest cover is more than 50% of original forest cover
Justification of choice of data or description of measurement methods and procedures applied:	
Purpose of data:	
Comments:	

Data/parameter [EA7]:	sc_2
Data unit:	[-]
Description:	Second shape factor for the forest scarcity equation; relative deforested area at which the deforestation rate will be 50% of the initial deforestation rate.
Sources of data:	
Value applied:	Not applicable as the % of remnant forest cover is more than 50% of original forest cover

Justification of choice of data or description of measurement methods and procedures applied:	
Purpose of data:	
Comments:	

Data/parameter [EA8]:	*wwf(ty)*
Data unit:	[-]
Description:	Fraction of carbon in harvested wood products that are emitted immediately because of mill inefficiency for wood class $ssee$. This can be estimated by multiplying the applicable fraction to the total amount of carbon in different harvested wood product category.
Sources of data:	The default applicable fraction is 24% and 19% respectively for developing and developed countries (Winjum et al. 1998).
Value applied:	24% for being a developing country.
Justification of choice of data or description of measurement methods and procedures applied:	Winjum et al. 1998 states that the default fraction is 24% for developing countries.
Purpose of data:	Calculation of project emissions;,
Comments:	Any new updates from locally generated results can be used instead of the default values.

Data/parameter [EA9]:	*slp(ty)*
Data unit:	[-]
Description:	Proportion of short-lived products
Sources of data:	Default values are 0.2, 0.1, 0.4 and 0.3 respectively for wood class $ssee$, i.e., sawn wood, wood-based panel, paper and paper boards and other industrial round woods as described in Winjum *et al*. (1998).
Value applied:	0.2 for being sawn wood
Justification of choice of data or description of measurement methods and procedures applied:	Winjum *et al*. (1998) provides the above values for sawnwood, woodbased panel, paper/paper boards and industrial roundwood
Purpose of data:	Calculation of project emissions
Comments:	Any new updates from locally generated results can be used instead of the default values. The methodology assumes that all other classes of wood products are emitted within 5 years.

Data/parameter [EA10]:	*fo(ty)*
Data unit:	[-]

Description:	Fraction of carbon that will be emitted to the atmosphere between 5 and 100 years of harvest for wood class $ssee$.
Sources of data:	See Table 19 (Winjum et al. 1998)
Value applied:	0.85 for being Sawnwood from a tropical forest region
Justification of choice of data or description of measurement methods and procedures applied:	Winjum et al. (1998) provides these values for the fraction of carbon that will be emitted into the atmosphere between 5 and 100 years after harvest for tropical wood classes.
Purpose of data:	Calculation of project emissions
Comments:	Any new updates from locally generated results can be used instead of the default values

Data/parameter [EA11]:	$\rho_{wood,j}$
Data unit:	[Mg DM m^{-3}]
Description:	Average basic wood density of species or species group RR
Sources of data:	GPG-LULUCF Table 3A.1.9 and Woods of Peru from the Research Institute of the Peruvian Amazon (IIAP) http://www.iiap.org.pe/Upload/Publicacion/CDinvestigacion/inia/inia-p4/inia-p4-02.htm
Value applied:	*Apuleia leiocarpa* 0.7 *Hymenaea sp.* 0.62 *Couratari guianensis* 0.54 *Erythroxylum catuaba* 0.42 *Cedrela odorata* 0.78 *Myroxylon balsamum* 0.43 *Amburana cearensis* 0.59 *Clarisia racemosa* 0.75 *Crepidospermum goudotianum* 0.87 *Aspidosperma macrocarpon* 0.93 *Manilkara bidentata* 0.92 *Aspidosperma rigidum* 0.45 *Dipteryx odorata* 0.7 *Tabebuia serratifolia* 0.62 *Cedrelinga catenaeformis* 0.54
Justification of choice of data or description of measurement methods and procedures applied:	IPCC table 3A. 1.9-2 provides average basic wood densities for multiple species in Tropical America. In the same way that Research Institute of the Peruvian Amazon
Purpose of data:	Calculation of project emissions

Comments:	When no species-specific or species-group specific densities are available, an average representative density may be used for all species or species groups.

3.3.2 Data and Parameters Monitored

NOTE: Estimations of quantifications in this section are preliminary and subject to confirmation during first verification stage due to methodology deviation No. 3 described in section 3.1.6.

Sizes, areas, and transitions

Data/parameter [MN1]:	$size_{projectArea}$, $size_{leakageArea}$, $size_{ReferenceRegion}$
Data unit	[ha]
Description	Size of project area, leakage area, reference region.
Source of data	Project design
Description of measurement methods and procedures to be applied	Coverage and demarcations will be monitored and created through the use of satellite imagery.
Frequency of monitoring/recording	$size_{projectArea}$ and $size_{leakageArea}$ may be adjusted during crediting period per the rules for grouped projects and updated at verification, but only for the additional instances that were added after the project start date. Permanent verification of the area of the project surfaces.
Value applied	$Size_{projectArea}$: 183,015; $Size_{leakageArea}$: 187764.7; $Size_{ReferenceRegion}$: 516554.217107
Monitoring equipment	Satellite imagery
QA/QC procedures to be applied	Raster files were converted to vectors. Area was calculated for each vector and compared to calculations based on raster file.
Purpose of data	Calculation of baseline emissions, Calculation of project emissions; Determination of baseline scenario, Calculation of leakage emissions
Calculation method	Multiplication of number of pixels (30m by 30m) in each region by 0.09 hectares pixel-1 for area in hectares.
Comments	

Data/parameter [MN2]:	$\Delta area_{projectAreaEAH,projectScenario}(t, i)$
Data unit	[ha yr^{-1}]
Description	Hectares undergoing transition ii within the project area, excluding ANR and harvest areas, under the project scenario during year ss. [ha yr^{-1}]. Section 8.2.3

Source of data	Remote sensing analysis
Description of measurement methods and procedures to be applied	Follow the procedures described in Section 3.2.2
Frequency of monitoring/recording	At least once before verification
Value applied	((183015.285-9352.187)/183015.285)*$D_{projectAreaprojectScenario.DF}^{(t)}$
Monitoring equipment	Software GIS, images Landsat,
QA/QC procedures to be applied	Field work or high-resolution images will be used to assess accuracy of results initially obtained. The application will be based on statistically robust parameters.
Purpose of data	Calculation of project emissions
Calculation method	Multiplication of number of pixels (30m by 30m) in each region by 0.09 hectares pixel-1 for area in hectares.
Comments	

Data/parameter [MN3]:	$\Delta area_{projectAreaEAH,BaselineScenario}(t, i)$
Data unit	[ha yr^{-1}]
Description	Hectares undergoing transition ii within the project area, excluding the ANR area, and harvest areas, under the baseline scenario for year ss.
Source of data	Land-use change for Geobosques (MINAM)
Description of measurement methods and procedures to be applied	Follow the procedures described in Section 3.2.1
Frequency of monitoring/recording	At least once before every baseline. For added instances, may be recalculated at verification.
Value applied	((183015.285-5070.788)/183015.285)*$D_{projectAreabaselineScenario.DF}^{(t)}$
Monitoring equipment	Software GIS, Landsat images
QA/QC procedures to be applied	Baseline scenario is defined once at validation. As this is not a grouped project, no new instances may be added..
Purpose of data	Calculation of baseline emissions; Determination of baseline scenario
Calculation method	Multiplication of number of pixels (30m by 30m) in each region by 0.09 hectares pixel-1 for area in hectares.
Comments	

Data/parameter [MN4]:	$\Delta areaprojectAreaWithANR,baselineScenario(t, i)$
Data unit	[ha yr^{-1}]
Description	Hectares undergoing transition i within the leakage area under the

	project scenario for year t
Source of data	Land-use change modeling
Description of measurement methods and procedures to be applied	Follow the procedures described in Section 8.1.5.4
Frequency of monitoring/recording	At least once before every baseline. For added instances, may be recalculated at verification.
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	
Calculation method	
Comments	Not applicability because ANR not included in project activity

Data/parameter [MN5]:	$\Delta area_{leakageArea,projectScenario}(t, i)$
Data unit	[ha yr^{-1}]
Description	Hectares undergoing transition ii within the leakage area under the project scenario for year ss
Source of data	Remote sensing analysis
Description of measurement methods and procedures to be applied	Coverage and demarcations will be monitored and created through the use of satellite imagery.
Frequency of monitoring/recording	At least once before verification
Value applied	$D_{leakageArea,projectScenario}^{(t,i)}$
Monitoring equipment	Software GIS, images Landsat
QA/QC procedures to be applied	Field work or high-resolution images will be used to assess accuracy of results initially obtained. The application will be based on statistically robust parameters.
Purpose of data	Calculation of project emissions
Calculation method	Multiplication of number of pixels (30m by 30m) in each region by 0.09 hectares pixel-1 for area in hectares.
Comments	

Data/parameter [MN6]:	$\Delta area_{leakageArea,baselineScenario}(t, i)$
Data unit	[ha yr^{-1}]
Description	Hectares undergoing transition ii within the leakage area under the baseline scenario during year ss

Source of data	Land use change for GEOBOSQUES (MINAM)
Description of measurement methods and procedures to be applied	Coverage and demarcations will be monitored and created through the use of satellite imagery.
Frequency of monitoring/recording	Once every baseline update. May also be updated at the time of instance inclusion that requires new leakage area.
Value applied	$D_{leakageArea,baselineScenario}^{(t,i)}$
Monitoring equipment	Software GIS, Landsat images
QA/QC procedures to be applied	Baseline scenario is defined once at validation. As this is not a grouped project, no new instances may be added...
Purpose of data	Calculation of project emissions
Calculation method	Multiplication of number of pixels (30m by 30m) in each region by 0.09 hectares pixel-1 for area in hectares.
Comments	

Data/parameter [MN7]:	$\Delta area_{historical}$ ($CS_1 \rightarrow CS_2$, $t_1 \rightarrow t_2$)
Data unit	[ha yr^{-1}]
Description	Area of transition from LULC class or forest stratum 1 to 2 from time 1 to 2 during the historical reference period
Source of data	Remote sensing analysis for Geobosques (MINAM)
Description of measurement methods and procedures to be applied	Calculate based on the remote sensing-based classification and stratification procedures detailed in Section 3.2.2
Frequency of monitoring/recording	At least once before every baseline update
Value applied	
Monitoring equipment	Software GIS, Landsat images
QA/QC procedures to be applied	75 pixels in forest stratum and 75 pixels in non-forest stratum will be analyzed with high resolution images
Purpose of data	Calculation of project emissions
Calculation method	Multiplication of number of pixels (30m by 30m) in each region by 0.09 hectares pixel-1 for area in hectares.
Comments	

Data/parameter [MN9]:	$area_{historical}$ (CS_1, t_1)
Data unit	[ha]
Description	Total area of LULC class or forest stratum 1 at time 1
Source of data	Remote sensing analysis for Geobosques (MINAM)

Description of measurement methods and procedures to be applied	Calculate based on the remote sensing-based classification and stratification procedures detailed in Section 3.2.2
Frequency of monitoring/recording	At least once before every baseline update
Value applied	
Monitoring equipment	Software GIS, Landsat images
QA/QC procedures to be applied	
Purpose of data	Calculation of project emissions
Calculation method	Multiplication of number of pixels (30m by 30m) in each region by 0.09 hectares pixel-1 for area in hectares.
Comments	

Data/parameter [MN10]:	$Area_{biomassloss}(i)$
Data unit	[ha yr^{-1}]
Description	Total annual area of LULC class i that was cleared for creating firebreaks
Source of data	Records of implemented activities or management plan
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	At least once before verification
Value applied	N/A
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	
Calculation method	
Comments	Not applicable because biomass loss for creating firebreaks not included in project activity

Data/parameter [MN11]:	$Area_{firebiomassloss}(i)$
Data unit	[ha yr^{-1}]
Description	Annual area of forest stratum i that was cleared by using prescribed burning
Source of data	Records of implemented activities or management plan
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	At least once before verification

Value applied	N/A
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	
Calculation method	
Comments	Not applicable because biomass loss for creating firebreaks not included in project activity

Data/parameter [MN12]:	$areafireBiomassLoss,ANR(t, i)$
Data unit	[ha]
Description	Area of biomass removed by prescribed burning within ANR stratum i during year t
Source of data	Records of implemented activities or management plan
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	At least once before verification
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	
Calculation method	
Comments	Not applicability because ANR not included in project activity

Data/parameter [MN13]:	$areaprojectAreaWithANR,projectScenario(t, i)$
Data unit	[ha]
Description	Amount of land on which ANR activities are planned under the project scenario for year t and in stratum i
Source of data	Records of implemented activities or management plan
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	At least once before verification
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	

Calculation method	
Comments	Not applicability because ANR not included in project activity

Data/parameter [MN14]:	Area $_{harvest}$(t, i)
Data unit	[ha]
Description	Area of forest in harvest stratum ii that is harvested at time ss.
Source of data	Project Description or Forest/Harvest Management Plan
Description of measurement methods and procedures to be applied	Forest analysis described in FMP
Frequency of monitoring/recording	At least once before verification
Value applied	2018: 9 352.187
Monitoring equipment	GPS
QA/QC procedures to be applied	
Purpose of data	Calculation of baseline emissions, Calculation of project emissions; Determination of baseline scenario
Calculation method	
Comments	

Data/parameter [MN15]:	$Area_{projectAreawithHarvest,ProjectScenario}$(t, i)
Data unit	[ha yr^{-1}]
Description	Size of strata ii within the project area with harvest activities during year ss under the project scenario.
Source of data	Forest/Harvest Management Plan
Description of measurement methods and procedures to be applied	Forest analysis described in FMP
Frequency of monitoring/recording	At least once before verification
Value applied	9352.187
Monitoring equipment	GPS
QA/QC procedures to be applied	
Purpose of data	Calculation of project emissions
Calculation method	
Comments	

Data/parameter [MN16]:	$Area_{projectAreawithHarvest,BaselineScenario}$(t, i)

Data unit	[ha yr^{-1}]
Description	Hectares undergoing transition ii within the harvest areas under the baseline scenario during year ss.
Source of data	Own Forest Management Plan
Description of measurement methods and procedures to be applied	Through an exploratory inventory
Frequency of monitoring/recording	At least once before every baseline update
Value applied	For the first five years (2018-2022): (5189.1814/183015.285191) * $D_{projectAreabaselineScenario.DF}^{(t)}$, and for the last five years (2023-2027): (5189.1814/183015.285191) * $D_{projectAreabaselineScenario.DF}^{(t)}$.
Monitoring equipment	GPS, software & hardware, laptop, compass
QA/QC procedures to be applied	
Purpose of data	Calculation of baseline emissions; Determination of baseline scenario
Calculation method	Not applicable
Comments	

Data/parameter [MN17]:	$BetaReg_{DF}$ (t) and $BetaReg_{DG}$ (t)
Data unit	[ha yr^{-1}]
Description	Beta regression model describing the relationship between time and deforestation/degradation rate in the reference region during the historical reference period.
Source of data	Historic forest degradation and deforestation modeling
Description of measurement methods and procedures to be applied	Procedure described in Section 8.1.5.1 or similar approach from peer-reviewed scientific literature.
Frequency of monitoring/recording	At least once every baseline update
Value applied	
Monitoring equipment	Statistical Software R-STUDIO
QA/QC procedures to be applied	
Purpose of data	Calculation of baseline emissions, Determination of baseline scenario
Calculation method	Applying a Beta Regression to historical values
Comments	

Locations, Descriptions, Qualitative and Social Data

Data/parameter [MN18]:	Area under agricultural intensification
Data unit	[ha]

Description	Size of the area of agricultural intensification separated for each agricultural intensification measure
Source of data	Participatory rural appraisals
Description of measurement methods and procedures to be applied	Calculate based on areas of cropland in the leakage and project areas
Frequency of monitoring/recording	At least once before verification
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	
Calculation method	
Comments	Not applicability because agricultural intensification activities not included in project activity

Data on Drivers and Actions

Data/parameter [MN27]:	$CT_{baseline}$ (h, j, ty, t)
Data unit	[m^3 yr^{-1}]
Description	Annually extracted volume of harvested timber round-wood for commercial on-sale under the baseline scenario during harvest h by species j and wood product class ty during year t
Source of data	1. Participatory rural appraisals conducted by the project proponent. 2. Recent (<10 yr) literature in the reference region 3. Recent (<10 yr) literature in an area similar to the reference region 4. Recent (<10 yr) non peer-reviewed reports by local organizations
Description of measurement methods and procedures to be applied	Cabinet work based on census results and legal minimum allowed DBH
Frequency of monitoring/recording	At least once before every baseline update
Value applied	See Workbook NER Hoja 7
Monitoring equipment	Computers, software, diametric ribbon, hypsometer, others
QA/QC procedures to be applied	A field brigade re-measures a percentage of measured trees
Purpose of data	Calculation of baseline emissions, Determination of baseline scenario
Calculation method	$\Sigma ((\pi * DBH^2)/4) * h$ for commercial species with DBH > minimum allowed
Comments	N.A.

Data/parameter [MN29]:	$CT_{project}(h, j, ty, t)$
Data unit	$[m^3\ yr^{-1}]$
Description	Annually extracted volume of harvested timber round-wood for commercial on-sale inside the project area under the project scenario during harvest h by species j and wood product class ty during year t.
Source of data	Project design, surveys, statistical records.
Description of measurement methods and procedures to be applied	Cabinet work based on census results and legal minimum allowed DBH
Frequency of monitoring/recording	At least once before verification
Value applied	See NET CARBON and VCU
Monitoring equipment	Computers, software, diametric ribbon, hypsometer, others
QA/QC procedures to be applied	A field brigade re-measures a percentage of measured trees
Purpose of data	Calculation of project emissions
Calculation method	$\Sigma ((\pi * DBH^2)/4) * h$ for commercial species with DBH > minimum allowed
Comments	N.A.

Data/parameter [MN33]:	$Contribution_{DF}$ (d) and $Contribution_{DG}$ (d)
Data unit	[-]
Description	Relative contribution of driver i respectively to total deforestation and forest degradation.
Source of data	LULC maps and statistics from GEOBOSQUES combined with Beta Regression. Methodology
Description of measurement methods and procedures to be applied	Application of the methodology based on GEOBOSQUES Data
Frequency of monitoring/recording	At least once before baseline update.
Value applied	See Workbook Calculations
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	Calculation of baseline emissions, Determination of baseline scenario
Calculation method	$contribution_{DF}(i) = \frac{proportion_{DF}(d) \cdot L(d)}{\Delta C_{DF}}$
Comments	

Data/parameter [MN34]:	$RelativeDriverImpact_{DF}$ (t,d) and $RelativeDriverImpact_{DG}$ (t,d)
Data unit	[-]

Description	Relative impact of the geographically unconstrained driver cc at time ss of the crediting period respectively on deforestation and forest degradation.
Source of data	Not applicable as no geographically unconstrained driver has been identified in the baseline scenario
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	At least once before baseline update.
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	Calculation of baseline emissions; Determination of baseline scenario
Calculation method	
Comments	

Data/parameter [MN35]:	leakageunconstrained $^{(d)}$
Data unit	[-]
Description	Leakage cancellation rate for avoiding deforestation/degradation from geographically unconstrained drivers.
Source of data	Valid sources to substantiate a smaller leakage rate include social assessments, scientific literature, and reports from civil society or governments. Sources have to be reliable and based on scientific methods and a good statistical design.
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	At least once before baseline update.
Value applied	A default rate of 100% was used as recommended by the methodology.
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	
Calculation method	
Comments	Not applicability.

Data/parameter [MN36]:	effectiveness(a, d)
Data unit	[-]

Description	Effectiveness of every project activity a in decreasing any driver of deforestation d relative to that driver's contribution to deforestation and forest degradation,
Source of data	Relevant academic literature or documented expert opinion.
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	At least once before baseline update.
Value applied	Alternative livelihoods: 0.312 Legal recognition of the land tenure status: 0.040 Demarcation and forest protection: 1.000
Monitoring equipment	The effectiveness(a,d) factor represents the maximal effectiveness during the crediting period.
QA/QC procedures to be applied	
Purpose of data	Calculation of baseline emissions, Calculation of project emissions; Determination of baseline scenario
Calculation method	
Comments	

Data/parameter [MN48]:	Efforest
Data unit	[t CO2 e]
Description	Emission factor related to leakage.
Source of data	1. If comprehensive national-level statistics on biomass densities are available, Efforest must be calculated based on the average biomass of the country. 2. If local data is not available. Sources of the data allowed are (1) academic research papers and (2) studies and reports published by the forestry administration or other organizations, including the FAO's Forest Resource Assessment reports, (3) the upper range of biomass in the GPG-LULUCF (2003) Table 3A.1.2.
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	At least once before verification
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	Calculation of baseline emissions, Calculation of project emissions; Determination of baseline scenario

Calculation method	
Comments	Not applicability.

Data on Organic Matter and Carbon Densities

Data/parameter [EA2]:	Carbon stock of the sources in the forest stratum.
Data unit	tCO2 e / ha
Description	Carbon stock by stratum in baseline before deforestation.
Source of data	Peru National Forest and Wildlife Inventory (2019).
Description of measurement methods and procedures to be applied	Calculations were done using EValidator tool built by US Forest Service in the context of National Forest Inventory, considering a statistical design for sampling of INFFS.
Frequency of monitoring/recording	At least once before verification
Value applied	t C/ha: Aboveground 138.84; tCO2e/ha: Aboveground 509.08
Monitoring equipment	Literature review
QA/QC procedures to be applied	
Purpose of data	Calculation of baseline emissions, Calculation of project emissions; Determination of baseline scenario
Calculation method	
Comments	

Data/parameter [MN49]:	$OM_o(i)$
Data unit	[Mg DM ha^{-1}]
Description	Plant-derived organic matter of LULC class or forest stratum i in pool o. [Mg DM ha^{-1}]
Source of data	Field measurements using sampling plots in forest strata or LULC classes.
Description of measurement methods and procedures to be applied	The average biomass stock density in applicable organic matter pools: aboveground tree – $OM_{AGT}(i)$, aboveground non-tree – $OM_{AGNT}(i)$, lying dead wood – $OM_{LDW}(i)$, standing dead wood $OM_{SDW}(i)$, belowground $OM_{BG}(i)$, and soil organic matter $OM_{SOM}(i)$
Frequency of monitoring/recording	At least once before every baseline update
Value applied	Follow uncertainty deduction procedures described in methodology.
Monitoring equipment	Re-measure plots by independent teams.
QA/QC procedures to be applied	Summed across multiple pools and divided into $OM_{plant}(i)$ and $OM_{soil}(i)$
Purpose of data	Calculation of baseline emissions, Calculation of project emissions; Determination of baseline scenario

Calculation method	
Comments	

Data/parameter [MN50]:	$Proportion_{DF}$ (d) and $Proportion_{DG}$ (d)
Data unit	[-]
Description	Proportion of the gradual carbon loss that leads to deforestation or forest degradation, respectively, due to driver d
Source of data	Estimate using the procedure detailed in Table 9.
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	At least once before every baseline update
Value applied	Driver: 1. Conversion of forest land to cropland; $proportion_{DF}(i)$: 100%; $proportion_{DG}(i)$: 0% Driver: 2. Conversion of forest land to settlements; $proportion_{DF}(i)$: 100%; $proportion_{DG}(i)$: 0% Driver: 3. Conversion of forest land to infrastructure; $proportion_{DF}(i)$: 100%; $proportion_{DG}(i)$: 0%
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	Calculation of baseline emissions, Calculation of project emissions; Determination of baseline scenario
Calculation method	
Comments	

Data/parameter [MN51]:	$C(t, i)$
Data unit	[Mg C ha-1 yr-1]
Description	Carbon stock density at time in stratum
Source of data	Estimate within the biomass inventory plots
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	At least once before verification
Value applied	515.8
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	Calculation of baseline emissions, Calculation of project emissions; Determination of baseline scenario
Calculation method	

Comments	

Data/parameter [MN52]:	$f_{allometric}(y)$
Data unit	Equation
Description	Algometric relationship to convert a tree metric such as DBH or tree height into biomass
Source of data	Forest National Inventory
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	At least once before every baseline update
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	Calculation of baseline emissions, Calculation of project emissions; Determination of baseline scenario
Calculation method	Algometric equations were used to calculate aboveground biomass by ecozone: AGB.t= ρ*Exp(-1.499+2.148*Ln(dap)+0.207*Ln(dap)^2– 0.0281*Ln(dap)^3. and to estimate necromasa of standing dead wood Vol = (π2∑(dn) 2)/(8*L). (INFFS 2019)
Comments	

Data/parameter [MN53]:	$f_{belowground}(y)$
Data unit	Equation
Description	Relationship between aboveground and belowground biomass, such as a root-to-shoot ratio
Source of data	National Forest and Wildlife Inventory (2019)
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	At least once before every baseline update
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	Calculation of baseline emissions, Calculation of project emissions; Determination of baseline scenario
Calculation method	BGB.t = 0.489*AGB.t$^{0.890}$
Comments	

Data/parameter [MN54]:	Charvest (t,i)
Data unit	Mg C ha-1
Description	Biomass carbon stock density at time t in stratum i in harvested areas.
Source of data	Field inventory
Description of measurement methods and procedures to be applied	Generic procedure is described in Section 8.1.4.4. Estimate must be made from plots located areas where harvesting takes place.
Frequency of monitoring/recording	At least once before verification
Value applied	404.4
Monitoring equipment	Carbon stocks in harvested strata must come from sampling. It may be necessary to include additional plots in harvested strata for a precise estimation of carbon stocks. The exact measurement of aboveground and below tree carbon must follow international standards and follow IPCC GPG LULUCF 2003. These measurements are explained in detail in CDM approved methodology AR-AM0002 Restoration of degraded lands through afforestation/reforestation.
QA/QC procedures to be applied	
Purpose of data	Calculation of baseline emissions, Calculation of project emissions; Determination of baseline scenario
Calculation method	Carbon Stock – (carbon content in timber harvested / harvested area)
Comments	

Data/parameter [MN55]:	Ceiinventory, harvest(t,i)
Data unit	[-]
Description	Combined error in estimate of average biomass stock density in harvest areas in stratum i at time t.
Source of data	Field inventory
Description of measurement methods and procedures to be applied	Generic procedure is described in Section 8.1.4.4. Estimate must be made from plot located in areas where harvesting takes place.
Frequency of monitoring/recording	At least once before verification
Value applied	
Monitoring equipment	Uncertainty estimate in carbon stocks in harvested strata must come from sampling of plots in harvested areas.
QA/QC procedures to be applied	
Purpose of data	Calculation of baseline emissions, Calculation of project emissions; Determination of baseline scenario
Calculation method	

Comments	

Data/parameter [MN56]:	$CE_{inventory,ANR(t,i)}$
Data unit	[-]
Description	Combined error in estimate of average biomass stock density in ANR areas in stratum I at time t
Source of data	Not applicable
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	
Calculation method	
Comments	

Data/parameter [MN57]:	$u$classification
Data unit	[-]
Description	Discounting factor for NERs from avoided deforestation, based on the accuracy of classification, i.e. dividing land into broad land use types.
Source of data	"Classification protocol for forest loss in Amazon Rainforest in years 2001-2011" (MINAM)
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	At least once before verification
Value applied	0.9733
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	Calculation of baseline emissions, Calculation of project emissions; Determination of baseline scenario
Calculation method	
Comments	

Data/parameter [MN58]:	$u$stratification

Data unit	[-]
Description	Discounting factor for NERs from avoided degradation, based on the accuracy of stratification, i.e. dividing forest into individual forest biomass classes. Section 8.1.2.7
Source of data	Not applicable
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	At least once before verification
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	Calculation of baseline emissions, Calculation of project emissions; Determination of baseline scenario
Calculation method	
Comments	

Data/parameter [MN59]:	$u$transition (i)
Data unit	[-]
Description	Discounting factor for the emission factor for the transition from LULC class or forest stratum 1 to class 2 according to the uncertainty of the biomass inventory.
Source of data	Forest National Forest and Wildlife Inventory (2019)
Description of measurement methods and procedures to be applied	Calculated based on raw data of INF
Frequency of monitoring/recording	At least once before verification
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	Calculation of baseline emissions, Calculation of project emissions; Determination of baseline scenario

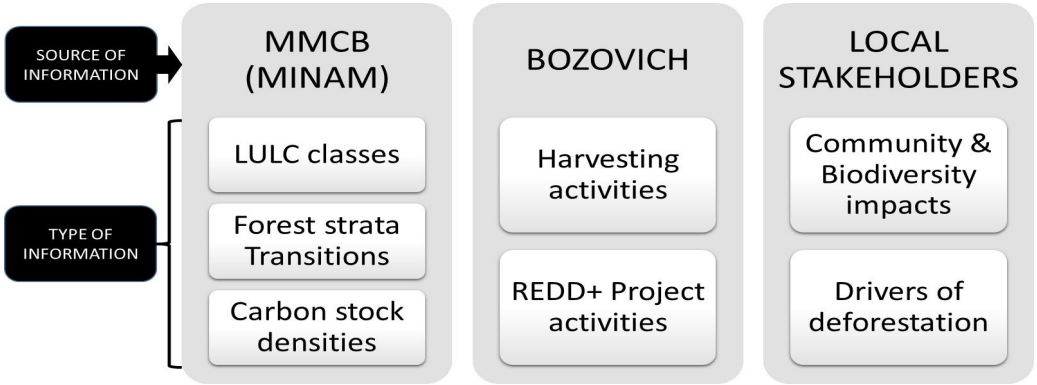
Calculation method	$$CE_{transition}(CS1 \rightarrow CS2) = \frac{\sqrt{\sum_o \left(HWCI\left(OM_o(CS1)\right)^2 + HWCI\left(OM_o(CS2)\right)^2\right)}}{\left\lvert \sum_o OM_o(CS2) - \sum_o OM_o(CS1) \right\rvert}$$ The uncertainty discounting for estimated emissions factors for a transition from one stratum to another is estimated using $$u_{transition}(CS1 \rightarrow CS2) = \begin{cases} 1 & \text{if } CE_{transition}(CS1 \rightarrow CS2) \leq 0.15, \\ 1 - CE_{transition}(CS1 \rightarrow CS2) & \text{if } 0.15 < CE_{transition}(CS1 \rightarrow CS2) < 1, \\ 0 & \text{if } CE_{transition}(CS1 \rightarrow CS2) \geq 1 \end{cases}$$ [EQ34]
Comments	

3.3.3 Monitoring Plan

As described in previous section, the monitoring plan must consider following issues:

- Drivers of deforestation, project activities and emissions sources related to REDD+ project activities inside and outside of the project area
- LULC class and forest strata transitions in the project area, leakage area, and reference region using remote-sensing technologies, and validated with ground-truthing data.
- Carbon stock densities in LULC classes and forest strata.
- Carbon stock in long-lived wood products.
- Natural disturbances.
- Monitoring of harvesting activities.

CHART 13: SOURCES OF INFORMATION BY TYPE



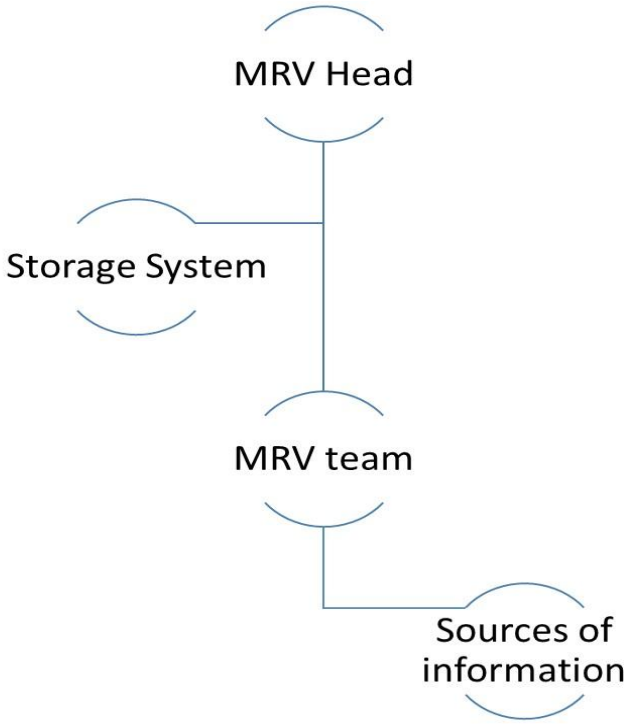
ORGANIZATIONAL STRUCTURE

Forestal Otorongo will implement a MRV Department composed by a head and an undetermined number of specialists, depending on the intensity of information that needs to be monitored, specially to monitor the community and biodiversity impacts and the REDD project activities.

The MRV will have two types of storage: a physical storage in FORESTAL OTORONGO offices and in a safe platform in the cloud, being MEGA the platform that is being explored.

The information will be recorded whenever the field operations are planned, during and after them, i.e. at the end of each campaign you will have the basic information to be able to carry out the respective reports. With the exception of internal audits that are carried out all year round. These reports that are taken out of the field are systematized in the company's office in Puerto Maldonado and stored on the company's server. Reports are presented to the monitoring manager for the preparation of the reports relevant to the project. Additionally, as a security measure against the risk of information loss, a backup is saved to physical storage media (CD-USB) and a copy that is stored in the MEGA cloud. In turn, each Area Manager must submit reports each time those activities occur.

CHART 14: MONITORING INSTITUTIONAL ARRANGEMENTS



Summarizing, the distribution of responsibilities and sources of information are detailed below for each one of the key data required. More detail is contained in section 3.2.

TABLE 114: DATA TO BE COLLECTED BY SOURCES

Data	Responsible	Source
Drivers of deforestation	Technical team	To be defined

project activities	Project proponent	Project proponent reports
emissions sources	Technical team	Project proponent reports
LULC class and forest strata transitions.	Technical team	MINAM
Carbon stock densities	Technical team	MINAM
Carbon stock in long-lived wood products	Technical team	Project proponent reports
Natural disturbances.	Technical team	Different sources
Monitoring of harvesting activities.	Project proponent	Own reports

3.3.3.1. Data

Methods for generating and storing data are described in the relevant Monitoring Manuals (see Annex 14). Forestal Otorongo will ensure that data is properly collected, stored, and reported in the Monitoring and Implementation Report prior to verification. Likewise, the MRV Head is responsible to ensure that all Manuals are adhered to by the team managers.

3.3.3.2. Quality Assurance and Control

Forestal Otorongo is responsible for creation and adoption of QA/QC protocols as required, and for any technical direction of the sector experts or teams. Forestal Otorongo is responsible to make sure the QA/QC protocols are carried out by the sector experts.

The Forestal Otorongo team minimize error by working as teams to check the identification of tree species and diameter measurements, and community and biodiversity data collected. These teams verify each other's readings. To reduce and eliminate transcriptional error spreadsheets is proofed by re-reading the field notebooks and comparing it to the data that has been entered.

All persons involved in the field measurement work will be fully trained to the current measurement manual before measurements. The dates of training sessions and the persons trained shall be recorded and stored. The team member names and team leader taking the measurements shall be recorded for each plot measurement.

All data will be reported to project proponents and local stakeholders and any discrepancies or disagreements will be rectified by explanation or joint visitation of activities in question. All publically available satellite data used in monitoring, validation, verification and certification will be archived and made available to auditors.

3.3.4 Dissemination of Monitoring Plan and Results (CL4.2)

Describe how the monitoring plan, and any results of monitoring undertaken in accordance with the monitoring plan, will be disseminated and made publicly available on the internet. Describe the means by which summaries (at minimum) of the monitoring plan and results will be communicated to the communities and other stakeholders.

FORESTAL OTORONGO will publicize the main results of its monitoring plan through its webpage and directly through workshops with authorities, communities and other stakeholders, as we have been doing to accomplish FSC standards since many years ago.

The monitoring report will include following topics:

- Climate Results
  - Land use change: every year
  - Carbon stock biomass: every 5 years
  - Carbon organic soil: every 5 years
- Community Results
  - Capacity development: every year
  - Sustainable incomes: every 5 years
  - Access to natural resources: every 5 years
  - Gender indicators: every year
- Biodiversity Results
  - FSC status: every year
  - Jaguar population: every 5 years

3.4 Optional Criterion: Climate Change Adaptation Benefits

Complete this section (3.4) if the project seeks to be validated to the Gold Level for climate change adaptation benefits. If not applicable, state so and leave this section blank.

3.4.1 Regional Climate Change Scenarios (GL1.1)

This section is not applicable

3.4.2 Climate Change Impacts (GL1.2)

This section is not applicable

3.4.3 Measures Needed and Designed for Adaptation (GL1.3)

This section is not applicable

4 COMMUNITY

4.1 Without-Project Community Scenario

4.1.1 Descriptions of Communities at Project Start (CM1.1)

There are four settlements that must be considered in this section to evaluate the impacts of project activities

- Carachamayoc
- San Francisco
- Portillo
- Arco Pacahuara

General Information:

There are some common aspects between the first three communities:

- Language: Spanish
- Origin: Regional
- Economic activities: agriculture, cattle ranching, bird breeding, small-scale logging in their own agrarian plots
- Local authorities (President):
    - Carachamayoc: Roberto Carlos Maguina
    - San Francisco: Manuel Rojas
    - Portillo: Martin Alberto Cuchitineri Jimenez
- Public services and entities: No schools and medical centers. The closest town with these services is Iberia.
- Population (number of families):
    - Carachamayoc: 103
    - San Francisco: 38
    - Portillo: 60

Specific information of each settlement:

1. **Carachamayoc**

It is a settlement association mostly dedicated to agriculture and bird breeding and at a lower scale to cattle ranching for self-consumption and trading in local market (Iberia). They also do small-scale logging but people do not talk about this activity openly.

Other authorities:

- President: Roberto Carlos Maguina. It is its second term. He lives in Iberia. He has a restaurant and is the supplier of lunches to a local school.
- Treasurer: Eduardo Aguilar
- Secretary: Gloria Aspajo
- Vice Major: Also Gloria Aspajo, who is a very influent person in the zone. She took office on May 6, 2018.

Population:

One hundred and three families are considered part of Carachamayoc, even though they do not have an official book of members, so they do not know exactly how many men and women are in the community but they know that most are men and the property titles are mostly registered on behalf of men.

Less than 10 families live not permanently in the area. Their walls and floors are wooden and ceilings are calamines (90%) or a type of bamboo called shapaja (10%). Most of the families are from Iberia (95%), the capital of province of Tahuamanu, while the other 5% comes from Cusco, Chiclayo and other Amazonian cities.

Accessibility and other communication services:

Carachamayoc is located 2.5 km from Iberia City. There is a float road between the two towns. An improvement of this neighborhood road has been approved by Special Project Madre de Dios (PEMD) and is expected to be concluded for the first semester of 2018.

The camp that will be built for this project may be transferred to the community to be used as a communal site when the project ends.

Two mobile phone companies operate in the area: Bitel and Movistar

Public services:

There is not electric light. The directive plans to request for a grant of solar panels.

There is no connection to drinking water system. Families use river water or water eyes

The disposals are eliminated through latrines. They have not heard about other technologies for waste management. Solid disposals are burnt.

Families use firewood for cooking.

Productive activities:

The main crops are corn, rice, banana and yucca

Logging is also practiced in the community but they do not practice sustainable forest management techniques neither agroforestry.

There is not a land zoning in the community neither soil analysis to know the potential and aptitude of them for each specific crop.

Monthly average income is between 300-400 soles

Education

Most of the population has not completed high school. There are no schools in Carachamayoc. Children has to go to Iberia for primary school and high school. Even though that, there are only three community members that have university and technician studies. A business administrator, a lawyer and a dental technician.

Health

As in education, there are no medical centers in the community so they depend on the medical post of Iberia.

The most common diseases within kids and adults are bronchia-respiratory diseases. Dengue is also a very frequent and dangerous disease and, at a lesser degree, the leishmaniasis.

2. **San Francisco**

It is the less populated settlement of the surrounding area. It is located at the north-east of the Concession. It is a landowners' association dedicated to agrarian and logging activities in their private plots.

Other authorities:

- President: Manuel Rojas
- Vice Major: Juan Chavez
- Teacher of Dos de Mayo Primary School: Julio Alvarado

The board will change soon.

Population:

Thirty-eight families are considered part of San Francisco, even though they do not have an official book of members, so they do not know exactly how many men and women are in the community but they know that most are men and the property titles are mostly registered on behalf of men.

Around 4-5 families live permanently in the community. Their walls and floors are wooden and ceilings are calamines (90%) or a type of bamboo called shapaja (10%). Most of the families are from Iberia (95%), the capital of province of Tahuamanu, while the other 5%, coming from Cusco, Chiclayo and other Amazonian cities, have purchased lands.

Around 15-18 members have titled their plots. The others are new members. The average size of each plot is 30 hectares but some of them have plots of 60 hectares.

Organization:

San Francisco is not registered as a legal association in SUNARP (national authority of properties registry). Nor they have RUC (the tax individual number) but they are interested about the implications of registering. They are associated to the Agrarian Federation of Tahuamanu

Accessibility and other communication services:

San Francisco is located 4.6 km from Iberia City. There is a float road between Iberia and Puerto Portillo. After crossing the bridge over Tahuamanu River and walking 3.4 km, San Francisco is located.

San Francisco authorities are surprised with the approval and execution by PEMD of a neighbor road to Carachamayoc considering that San Francisco was very active and is populated by more families.

Public services:

There is not electric light.

There is no connection to drinking water system. Families use river water or water eyes

The disposals are eliminated through latrines. They have not heard about other technologies for waste management. Solid disposals are burnt.

Families use firewood for cooking.

Productive activities:

They used to cultivate rice until two years ago. Since then, production of banana and corn (around 1-3 hectares per family) has increased for sale.

No land zoning in the community nor soil analysis to determine the more appropriate crops to each type of soil.

No logging, agroforestry or similar sustainable techniques

Family monthly average income is between 300-400 soles

Education

There are no schools in San Francisco. Children has to go to Iberia for primary school and high school.

Health

As in education, there are no medical centers in the community because people do not live in the town. They use Iberia Post.

3. Portillo

It is a settlement association mostly dedicated to agriculture, cattle ranching and small-scale logging from their own plots. They cover 4000 ha, but, according to its authorities, only 30% of that area have made "improvements" as defined by Agrarian Directorate, which is equivalent to slash and burn to replace forest by a crop or grazing.

Authorities:

- President: Martin Alberto Cuchitineri Jiménez (he transferred the charge to Gabriel Contreras.)
- Attorney: Roger Contreras
- Voice: José Gabriel Contreras

Population:

The first families came here between 50-60 years ago. Currently, there are around 60 families, considered as partners of this sector. Even though that, the authorities interviewed consider that only 15 families are active. They do not have an official book of members, so they do not know exactly how many men and women are in the community but they know that most are men and the property titles are mostly registered on behalf of men. Around 10 families live permanently in the area. Walls and floor are wooden and ceilings are 90% of calaminas and 10% of shapaja.

Around 95% of people is born in Iberia while the other 5% is migrant and has purchased their plots.

Land tenure types:

Approximately 30% of the plots are titled but they are still waiting for a re-measurement of their plots. Compared with Carachamayoc, Portillo has a lower percentage of titled plots but a higher production.

The average size of each plot is 32 hectares, but the largest plot is 60 hectares, as in the neighboring settlements.

As said before, the total area is 4000 hectares.

Organization:

Portillo is not registered as a legal association in SUNARP. Nor they have RUC but they are interested about the implications of registering. They are also members of the Agrarian Federation of Tahuamanu.

Accessibility and other communication services:

Portillo is located 3.5 km from Iberia City. There is a float road between Iberia and Puerto Portillo. After crossing the bridge over Tahuamanu River, Portillo is located through the same walk from Carachamayoc.

Portillo authorities are also surprised with the approval and execution by PEMD of a neighbor road to Carachamayoc considering that Portillo has a higher production and is populated by more families. Based on that, they plan to talk directly with PEMD managers and the constructors to pay them on Sundays and holidays to work on the improvement of their own road.

Public services:

There is not electric light.

There is no connection to drinking water system. Families use river water or water eyes.

The disposals are eliminated through latrines. They have not heard about other technologies for waste management. Solid disposals are burnt.

Families use firewood for cooking.

Productive activities:

They cultivate corn (1-3 ha) and at a lesser degree, banana and yucca (0.25 ha).

Cattle ranching is important. Each member has between 10 to 120 hectares of pastures, with around 10 to 150 animals.

They harvest timber but they do not do sustainable forestry management neither agroforestry nor other sustainable techniques

No land zoning in the community nor soil analysis to determine the more appropriate crops to each type of soil.

Family monthly average income is between 300-400 soles

Education

Most of members of Portillo do not have completed the high school. There are no schools in San Francisco. Children has to go to Iberia for primary school and high school, even though there was a primary school but it was closed because of the insufficient number of students.

Health

As in education, there are no medical centers in the community because people do not live in the town. They use Iberia Post.

4. **Arca Pacahuara:**

It is a religious community from the "Israelitas del Nuevo Pacto Universal" faith, which is politically represented by FREPAP (Peruvian Agrarian and Popular Front) political party. The current major of Iberia, Gustavo Mamani, was elected by this party and is member of the community.

They have a total area of 6000 hectares but they have a formal requirement to the Regional Agrarian Directorate for 26,000 new hectares to expand their cultivation area. This request is under dispute because the requested area is overlapping with other land rights as forest concessions, especially two forest concessions, who accuse Arca Pacahuara to invade their forest concession for their agricultural activities.

They are migrants from the Andes. They are around three thousands of inhabitants and growing. Considering that the electoral universe of Iberia is 3,668 persons, it is clear that this community is key to define the policy decisions in this district. This also explains why they receive the benefits from many public investments and projects. In 2017, they have been supported with a water and drain connection project by S/. 11 million.

Because of its aggressive agrarian practices, they do not have remaining forests in their land so they are always looking for new lands to expand their crop plans. They produce around 30 hectares per family, principally corn that is sold to Granjas Amazónicas S.A. There are around 600 hectares of corn established, 400 of them are already in production. If they are not controlled, they can grow forever, affecting neighboring forests. Their current production only represents 10-15% of annual demand of Granjas Amazónicas, even though they are its main suppliers. According to specialists, expanding their agrarian frontier is always profitable.

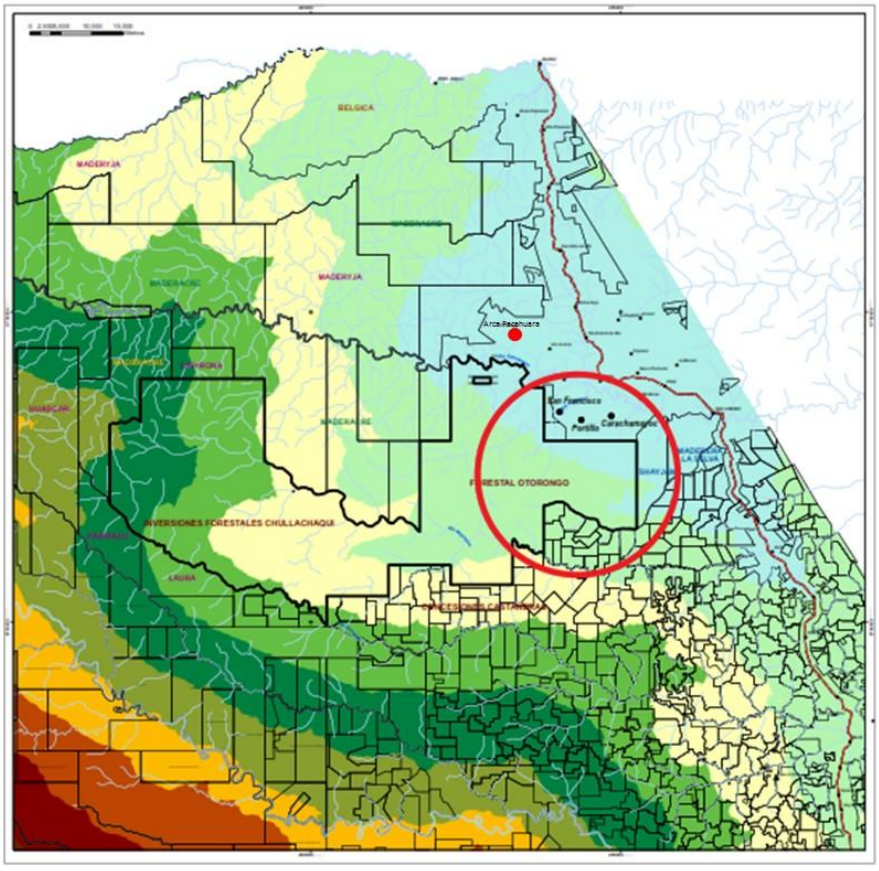
Concessionaries as Federico Rios, among others, are in a legal conflict with this community because they have invaded his forest concession.

According to specialists as the Eng. Ernesto Vargas, from the Forest and Wildlife Directorate of Iberia, the people from this community "has an unstoppable expansion. The Interoceanic Highway created many new opportunities for migrants searching lands. Pacahuara continues inviting new migrants. The invasions are permanent, and everything goes unpunished. Because they have their own governing system, we must be very careful. They burn forest and they need every time more area. They are the main suppliers of Granjas Amazónicas. They have the mandate to work in agriculture and produce. At 4:30am, they start to wake up: "brothers, let's work". At 5:15am, you start listening the motorcycles driving along. The expansion and titling is a problem now. Foresters have the agriculture as the main driver of deforestation. It does not matter for them if protection forests are destroyed. It is a latent enemy. They claim land constantly".

As can be concluded from the analysis in this section, Arca Pacahuara is the main threat to adjacent forest.

In the following map, the four communities described below can be found. Three of them are very close to Forestal Otorongo, in the north-east border of the concession, while Arca Pacahuara, in the northern border of the concession, even though is further away from the concession, has a higher rate of expansion as can be seen later.

MAP 39: SURROUNDING COMMUNITIES LOCATION



4.1.2 Interactions between Communities and Community Groups (CM1.1)

Communities characterized in previous section combine partnership and conflict relationships. As described in that section, Portillo, San Francisco and Carachamayoc, even though there are some differences and conflicts between them for access to benefits from public services, they use to be together when they demand excessive preference with Arca Pacahuara.

There are many cultural and religious differences between the first three communities and Arca Pacahuara.

Other stakeholders in the area may be loggers and Brazil nut harvesters. Even though this is an area with a large tradition of logging activities, there have not been loggers in the project area.

On the other hand, with the Brazil nut harvesters, the relationship is very good and they are allowed to harvest the BN. They are hired by the project proponent for the harvesting of Brazil nuts.

The relationship between the project proponent and neighboring settlements are positive.

4.1.3 High Conservation Values (CM1.2)

TABLE 115: COMMUNITY HCV

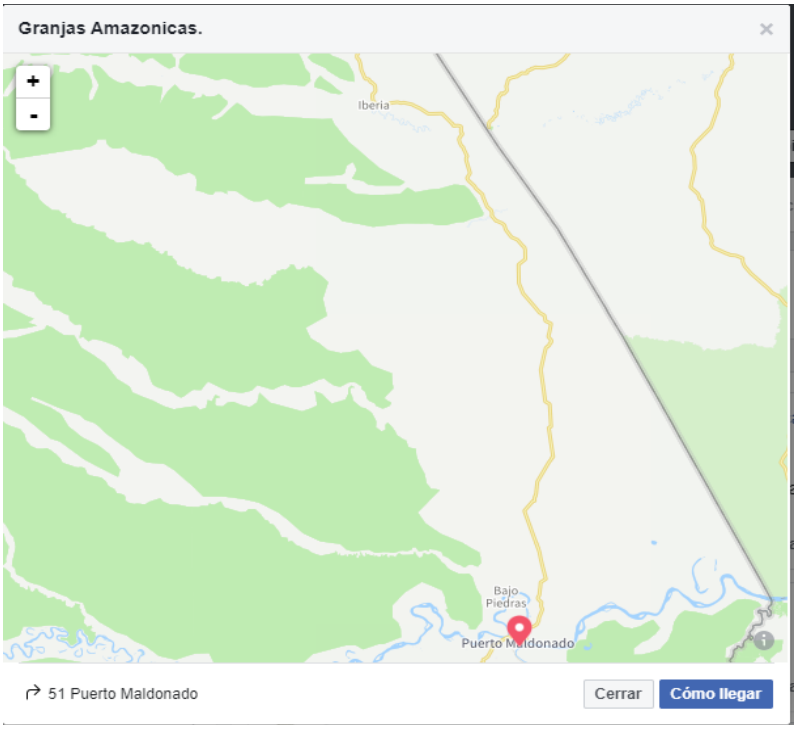
High Conservation Value	Significant concentration of global/national/regional biodiversity values at Forestal Otorongo and Chullachaqui Forest Investments. Large forests at landscape scale, significant at a global/national/regional level.
Qualifying Attribute	Both concessions are the habitat of Mahogany (*Swietenia macrophylla*) and Jaguar (Panthera Onca), which are included in all the Peruvian regional and national lists of conservation status. Other species as the Brazil nut (Bertholletia Excelsa) are also included in the Ministerial Resolution N° 729-AG-DGFF.
Focal Area	These two species are spread alongside all the concessions. In the case of Jaguar, this hunting is completely forbidden within the concessions and this is monitored periodically. In the case of flora, in addition to the reduced impact logging (RIL), used in the concessions and an environmental impact assessment is carried out, we take in consideration the yearly Mahogany (*Swietenia macrophylla*) Non-Detriment Finding (DENP), prepared by Peruvian Scientific Authority of CITES. This allows the conservation and restoration of key species as seedlings and future harvesting. Forestal Otorongo works with a minimum cutting diameter over the legally required level. In addition, we do EIA, we train personnel and local families and we have a permanent monitoring system of the impacts of the operations.

4.1.4 Without-Project Scenario: Community (CM1.3)

The scenario of the project area is very concerning without project intervention. According to interviewed specialists, more than 80% of Forestal Otorongo concession is under risk to be lost by the expansion of Arca Pacahuara activities. When it happens, they will continue expanding to the other concessions as Chullachaqui. This can be seen in map 39, which extrapolates the expected area of expansion:

It is reasonable to think that the expansion will move mostly to south because the market demand for its main product, corn, Granjas Amazonicas, is located in Puerto Maldonado.

MAP 40: DISTANCE TO CORN MARKETS



It is likely the same scenario, but at a lower scale, for the other three communities and maybe new migrants can fund new settlements.

4.2 Net Positive Community Impacts

4.2.1 Expected Community Impacts (CM2.1)

The Jaguar Amazon REDD+ Project will have significant positive impacts on neighboring communities of the project. The expected impacts of the Project on communities are:

- Increased incomes
- Increase of high-quality employment (safer labor conditions than traditional logging)
- Enhanced skills on forest management and forest certification
- Biodiversity conservation (and access allowance to natural resources)
- Maintenance of biological connectivity

On the other side, there are potential negative impacts as:

- Limited access to families that used to practice unsustainable use of natural resources (logging, hunting and, in general, overexploitation of forest and wildlife resources)

As part of its corporate responsibility, Forestal Otorongo will prepare and diffuse a Communication Protocol to key stakeholders, explaining the expected impacts that the project will bring to neighboring communities and how they can organize and develop a joint plan to take these opportunities and to deal with the negative impacts and how to offer alternatives to compensate those impacts. At this moment, Forestal Otorongo has developed a "Handbook for Conflict Resolution", which is a basis and an input for the Communication Protocol.

TABLE 116: IMPACTS OF THE PROJECT ON KEY STAKEHOLDERS

Stakeholder	Type of impact	Level of impact	Description
Forestal Otorongo	+	High	The forest operations will be improved and the connectivity enhanced thanks to the incomes of carbon sales.
San Francisco, Portillo, Carachamayoc	+	High	They will have the opportunity to increase their opportunities, incomes, diversification, sustainable production, access to markets and other benefits thanks to the support of project proponent.
Arca Pacahuara	-	High	Even though the impact could be positive, if this religious community could take advantage of technical assistance offered by FORESTAL OTORONGO to implement sustainable land use practices instead of continue clearing new forest areas, their faith demands to continue working on unsustainable agrarian activities, which, in this case, if they are done in lands where they do not have rights or areas that doesn't have agrarian aptitude, will face an increased governance and enforcement by the strengthening of forest authority.
SERFOR and Forest Regional Authority	+	High	The impact is positive and high because the presence of the concessions is not only a source of income for the Authority but a success example, not only in the district but in the region and in the whole country too.

4.2.2 Negative Community Impact Mitigation (CM2.2)

The only identified negative impact is a ban to unsustainable use of natural resources within the forest concession. These practices are not legally allowed but are traditionally done by local families.

Forestal Otorongo will not only give preferences to local families to work in the company operations, but will also support them with training and seed capital to start small enterprises as fish farming and wildlife husbandry. By doing this, families will be able to access to the same level of proteins and nutrients without affecting the biodiversity of the zone.

4.2.3 Net Positive Community Well-Being (CM2.3, GL1.4)

Based on previous analysis, the project expects to generate a positive net impact on surrounding communities. The different aspects or dimensions that will be permanently modified by the project are not equivalent in nature and cannot be adequately compared. For this reason, we plan to monitor the net impact of the project on communities in each type of impact:

As explained before, the type of impacts identified are:

INCOMES + SKILLS + ACCESS TO NATURAL RESOURCES

Income:

- Positive (from increased employment, economic chains, sale of natural resources, and others)
- Negative (from limited access to unsustainable use of natural resources)

Skills:

- Positive (number of trainings received by workers and other members of the communities)

Access to natural resources:

- To be estimated (volume of natural resources harvested for self-consumption)

4.2.4 High Conservation Values Protected (CM2.4)

The HCVs present within the project area will not be affected because the activities of the project will not have incidence over those HCV indicators as “Significant level of concentration of biodiversity value at a global, regional or national level” or “Large and significant, at a landscape scale, forests at a global, regional or national level”. It is the same scenario in both concessions.

4.3 Other Stakeholder Impacts

4.3.1 Impacts on Other Stakeholders (CM3.1)

TABLE 117: IMPACTS OF THE PROJECT ON OTHER STAKEHOLDERS

Stakeholder	Type of impact	Level of impact	Description
Municipality	+	Low	The impact is positive but low as the concessions are two of the largest companies in the district, so their taxes are significant in the municipality income scheme
Ministry of Environment	+	Medium	MINAM is interested that this type of initiatives consolidate is it helps to reduce GHG emissions, contributing to NDC committed in the framework of Paris Agreement

Brazil nut concessions	0	Medium	As explained before, the area has Brazil nut trees inside so the company has made agreements with BN concessionaries to allow them to harvest the BN pods. It is important to highlight that the BN harvesting, as it is a Non-Timber Forest Product, is the typical sustainable production model. The impact is medium and neutral because the presence of the company does not imply any restriction to the BN activity.
Agricultural Producers	-	High	The main deforestation driver in the surrounding forest area is, in words of the Director of DRA, the migration in search of new lands for agrarian use, even though it is not allowed. The presence of the company blocks the intention of migrants to expand their agricultural crops to these forests. As there is a risk that they displace to other forest areas, the project plans to train in alternative sustainable activities.
Cattle ranchers	-	High	Similar to the previous stakeholder.
Timber concessions	+	High	There are many dimensions of the impact between timber concessions: the price of the timber, the open and shared maintenance of roads, the competition on processing services, etc. According to our assessment, the impact is positive because a successful timber concession increases the probability of success to neighbors as they act as a cluster, increasing the competitiveness of the value chain and the lessons learned.
Suppliers of goods and services in the timber value chain	+	High	It is doubtless that the Forestal Otorongo Group is a major engine of local economic dynamic, creating direct and indirect employment as food suppliers, transportation services, and timber processing services, among others.
Academic and research entities	+	High	The company offers unique opportunities for local students and teachers to do practices and researches within and around the forest concessions. This is reflected in the Cooperation Agreements signed between the concession and a Technological Institute of the vicinity. Thanks to these Agreements, students and graduated may do pre-professional practices and researches, adequate to national educational requirements. Even more, concessions offer training, hosting and food, and access to raw data collected during the many years working in the area, which is invaluable for their thesis, researches and as experience for their future professional life. It is a win-win scheme.

4.3.2 Mitigation of Negative Impacts on Other Stakeholders (CM3.2)

The main strategy of Forestal Otorongo to mitigate the negative impacts is composed by many of the actions described below, including training in alternative economic opportunities and link with educational institutes. It is clear that the company itself is not in charge of forest conservation and control of migrant activities. This is a responsibility of municipalities, regional government and forest authority. The company is responsible for caring the forests within the concession. Said that, the activities that are part of the strategy are:

- In the short term, create alternative economic activities for local families and alternative methods for own production than can ensure the food security of the rural families
- In the medium term, strengthen applied and professional capacities in students to promote a sustainable use of forest resources

4.3.3 Net Impacts on Other Stakeholders (CM3.3)

Similarly, to what was developed in section 4.2.3, the impacts on other stakeholders may be grouped in the same following categories with the difference that the sources of each impact come from a different stakeholder and activity:

INCOMES + SKILLS + ACCESS TO NATURAL RESOURCES + GOVERNANCE

- Income:
  - Positive (taxes, employment, sale of inputs, sale of natural goods and services, etc.)
  - Negative (ban to unsustainable use of natural resources, ban of agrarian frontier expansion)
- Skills:
  - Positive (students and graduated supported)
- Access to natural resources:
  - To be determined (self-consumption of natural resources, agrarian productivity and area)
- Governance:
  - Positive (managed forestland)

4.4 Community Impact Monitoring

4.4.1 Community Monitoring Plan (CM4.1, CM4.2, GL1.4, GL2.2, GL2.3, GL2.5)

A monitoring plan will be carried out by the project proponent as described in the following charts and graphs:

TABLE 118: COMMUNITY MONITORING MATRIX

Variable	Communities	Method	Frequency	Comments
Family incomes	Portillo Carachamayoc San Francisco Arca Pacahuara	Focus Group	Annual	This variable will be progressively built by determining the sources of income, the percentage of members that access to each type of income, the average area, yield and production, the percentage of total production sold in markets and the average price received. In addition, the average cost of the whole production chain will be obtained for each type of source of income.

Trainings received	Portillo Carachamayoc San Francisco Arca Pacahuara	Focus group	Annual	The number of trainings received by category (related with logging operations or with alternative sustainable economic activities) will be counted and the percentage of families that have accessed to these trainings.
Basket of forest goods harvested	Portillo Carachamayoc San Francisco Arca Pacahuara	Focus group	Annual	A basket of all goods and services that families obtain from the surrounding forests, estimating the average amount harvested per year per family and calculating the average cost of each product (or its substitute) that the family will have to pay in case they cannot get it from the forest.

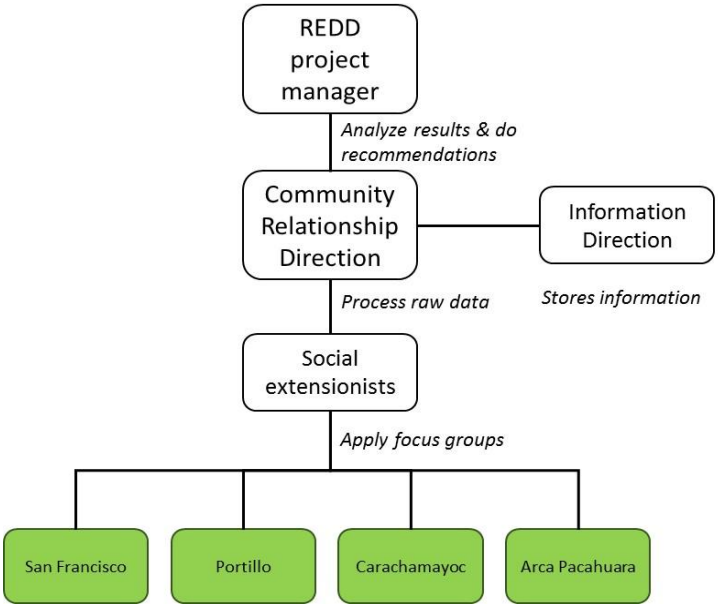
The number of families that will be part of the focus group in each community will be statistically determined by keeping proportionality between gender, age, size of farmer and other relevant criteria. This will be determined lately.

There are different scenarios than may occur, including mixed impacts as the following ones:

- Net positive impact in some indicators but net negative impact in other indicators
- Net positive impacts in some communities but net negative impacts in other communities

Results will be segregated and highlighted not only by community but also by gender and size of farmer in order to evaluate if the project may access to gold level thanks to their exceptional (positive) impacts on vulnerable groups as women and small farmers. There are no indigenous communities with the influence area of the project. Finally, the following graph shows the role of different areas of the company that will be in charge of the implementation of the current plan:

CHART 15: COMMUNITY AREA INTERNAL STRUCTURE



4.4.2 Monitoring Plan Dissemination (CM4.3)

The monitoring plan and the annual monitoring reports will be accessible in the webpage of the company Group so any interested may access not only to processed results but also to raw data that was the basis to establish the final results, only protecting the confidentiality of the families that have participated in the focus groups.

Nevertheless, there will be other ways of sharing these results with stakeholders.

- An annual meeting leaded by the general manager of Forestal Otorongo will be conducted with the leaders and authorities of the four communities to socialize and discuss the results obtained, comparing them with results from previous years, analyzing which variables have improved and which have diminished. This analysis should end with recommendations and agreements to make adjustments in the relationship between the company and the communities.
- An annual meeting leaded by the general manager of Forestal Otorongo with other stakeholders (forest authorities, municipalities, technical institutes, among others) to analyze the same results and obtain recommendations of improvements.

Every 10 years, a book with the main impacts of the REDD project on community and biodiversity variables will be published.

4.5 Optional Criterion: Exceptional Community Benefits

Even though its exceptional community benefits that Jaguar REDD Project expects to bring to surrounding communities, the project does not plan to apply to Community CCB Gold Level

4.5.1 Exceptional Community Criteria (GL2.1)

4.5.2 Short-term and Long-term Community Benefits (GL2.2)

4.5.3 Community Participation Risks (GL2.3)

4.5.4 Marginalized and/or Vulnerable Community Groups (GL2.4)

4.5.5 Net Impacts on Women (GL2.5)

4.5.6 Benefit Sharing Mechanisms (GL2.6)

4.5.7 Benefits, Costs, and Risks Communication (GL2.7)

4.5.8 Governance and Implementation Structures (GL2.8)

4.5.9 Smallholders/Community Members Capacity Development (GL2.9)

5 BIODIVERSITY

5.1 Without-Project Biodiversity Scenario

5.1.1 Existing Conditions (B1.1)

Madre de Dios is a region recognized worldwide for its high biological diversity (Voss & Emmons, 1996), which is why it has been awarded the title of Biodiversity Capital of Peru. It is estimated that one of the "Pleistocene Refuges" of the planet is in this Department and 50% of the diversity and endemism is found at the country level. A large part of this biological diversity is represented in its Natural Protected Areas. Since 1973, with the creation of Manu National Park to date, six Natural Protected Areas (NPAs) have been created in the department, some of which are shared with other regions. The following units make up the department's PNA system: Manu National Park, Manu Reserved Zone, Bahuaja-Sonene National Park, Alto Purús National Park, Tambopata Candamo National Reserve, Amarakaeri Communal Reserve and Purús Communal Reserve. Together, these areas cover 3'784,081 ha representing 44.6 percent of the department's territory. (IIAP, GOREMAD, 2009) and this percentage continues to increase due to new protected areas such as the Indigenous Reserve in Voluntary Isolation, Tourism Concessions, Conservation Concessions, and private Conservation Areas.

Kometter (2003)[32] conducted vegetation characterization studies in the department of Madre de Dios. According to their classification, the forests in the project have the following characteristics:

- Low Hill Forest (BCb): The forest is established on areas that have a tectonic origin but that have also been shaped by water erosion, having accentuated the ruggedness of its topography, presenting slopes that can reach up to 70%, likewise the relative height to which the elevation of these hills can reach is up to 80 m. This type of forest presents subtypes such as forests of different vigor, forest with Paca, pacal and associations have been found with Shiringa.
- High Hill Forest (BCa): The physiography on which this type of forest develops presents undulations with elevations that can reach up to 200 m of relative height; the slopes that they present are of moderate to strong, reaching up to 100%. This type of forest presents subtypes such as forests of different vigor, forest with bales and pacal.
- Low Terrace Forest (BTb): This forest develops on land located generally after the alluvial flood zone, with a relative height above river level of less than 10 meters, relatively flat with some depressions, regular to bad drainage. This type of forest has subtypes such as forests of different vigor, forest with bales and pacal.
- High Terrace Forest (BTa): Generally located around second order rivers or streams. In some areas of the study area, they are found in the highest parts forming a kind of plateau. They have flat to slightly undulating topography, slopes ranging from 0 to 8%, no drainage problems, and are made up of old alluvial materials. This type of forest presents subtypes such as forests of different vigor, forest with bales and pacal, and associations with Brazil nut were found.

[32] Mapping and Forest Assessment of the Permanent Production Forest of the Department of Madre de Dios.

The project presents a considerable extension of moderately conserved forest, and its existence as a concession is considered the only barrier to the protection of populations of species of wild flora and fauna. Because of its size (more than 180,000 hectares), it is key to the connectivity of large mammals.

According to the threat categories of the Ministry of Agriculture, 16 mammalian species with some degree of threat are registered in the Madre de Dios region (Supreme Decree 034-2004/AG). Mammals such as the choro monkey (Lagothrix lagotricha) are at risk, although previously widely distributed in the region but with sparsely dense populations in areas of high and primary forest, now threatened by their vulnerability to intervention and alteration of their habitat and their quoted meat, such as hunting trophy and exotic pet (Aquino and Encarnación 1994); the river wolf (Pteronura brasiliensis), the pacarana (Dinomys branickii), distributed throughout the Amazon basin but with more records on the river Madre de Dios. In a vulnerable situation we have spider monkey or Maquisapa (*Ateles chamek*), a resident of dense and lush forests or primary forests, this species is affected by hunting pressure and deforestation (Aquino and Encarnación 1994).

The Añuje (Dasyprocta kalinowskii), the flag or bear flag (*Myrmecophaga tridactyla*), the giant armadillo (Priodontes maximus), the tapir (Tapirus terrestrial) are also widely distributed within the Madre de Dios region, threatened by the high pressure of subsistence hunting, among human settlements. For the water mouse (Neusticomys peruviensis) and Laval bat (Thyroptera lavali), habitat loss is the biggest threat (Pacheco 2002). Among other important species we have the bush dog (Speothos venaticus), widely distributed in the Amazon basin but very rare to observe (Solari et al., 2006), also the short ear dog (Atelocynus microtis), all these Amazonian canids are categorized within CITES I.

The mammals most sensitive to hunting pressure, which requires more awareness-raising actions, are Sachavaca and primates. Because they have long gestation periods and slow development, high hunting pressure leads to a rapid decline in their populations. Compared to primates, Saxins and Huangans, they have a better response to the decline in their populations, making them less sensitive to intense hunting pressure.

The project area has attributes of high biological and ecological value, maintains important wildlife species, diversity of natural landscapes, and the unique beauty of the Collpas. The richness and diversity of species is linked to the diversity of habitats and the abundance of food, a fundamental element to guarantee the stability of animal populations.

Biodiversity studies conducted in the project area, as part of the Forest Stewardship Council (FSC) Standard certification of forest management, found several species of threatened wildlife. The degrees of threat of the species found were updated with respect to Supreme Decree 004-2014-MINAGRI, if they are considered CITES species and, on the IUCN, red list. These will be detailed below:

TABLE 119: WILDLIFE SPECIES WITH SOME DEGREE OF THREAT

Common Name	Scientific Name	D.S. N°004-2014-MINAGRI	CITES[33]	IUCN[34]
Mammals				
Agoutis	*Dasyprocta sp.*			
Red squirrel	*Sciurus pymhinus*	Insufficient data		

[33] https://speciesplus.net/species
[34] https://www.iucnredlist.org/

Spider Monkeys	*Ateles paniscus*	Vulnerable	II	
White Monkey	*Cebus albifrons*		II	LC
Common Squirrel Monkey	*Saimiri sciureus*		II	LC
Monkey preserve	*Alouatta seniculus*	Almost threatened	II	LC
Black Monkey	*Cebus (sapajus) paella*		II	LC
Little monkey	*Saguinus fuscicollis*		II	LC
Stump monkey	*Cebus (Plecturocebus) Moloch*		II	LC
Bear flag	*Myrmecophaga trydactila*		II	VU
Puma	*Puma concolor*	Almost threatened	I	LC
Otorongo	*Panthera once*	Almost threatened	I	NT
Sachavaca	*Tapirus terrestris*	Almost threatened	II	VU
Wild pig	*Tayassu (Pecari) tajacu*		II	LC
Huangana	*Tayassu pecari*	Almost threatened	II	VU
Ashy Deer	*Mazama gouazoubira*			LC
Red Deer	*Mazama Americana*	Insufficient data		DD
Birds[35]				
Harpy Eagle	*Harpia harpyja*	Vulnerable	I	NT
Tatatau	*Daptrius (Ibycter) americanus*		II	LC
Paujil	*Mitu tuberosum*	Almost threatened		LC
Tinker Bell Kettle	*Pipile cumanensis*	Almost threatened		LC
Trumpeter	*Psophia leucoptera*			NT
Aurora	*Ara severus*	Vulnerable	II	LC
Macaw	*Ara macao*	Vulnerable	I	LC
Panguana	*Crypturellus undulates*		I	LC
Partridge	*Tinamus sp.*			
Reptiles[36]				
Motelo	*Geochelone (Chelonoidis) denticulata*	Danger	II	VU
Black Caiman	*Melanosuchus niger*	Vulnerable	I	LR

Source: PGMF Otorongo, PGMF Chullachaqui

Of the mammal species found in the assessment, two species are found as Vulnerable: The Otorongo (Panthera onca) and Huangana (*Tayassu pecari*) on the IUCN list and on the CITES I and II list respectively.

[35] For this list, DS034-2004-AG is still used because a part has not been published.
[36] For this list, DS034-2004-AG is still used because a part has not been published.

The Otorongo, or Jaguar (Panthera Onca), is found at the top of the food chain pyramid and its existence is an unavoidable sign of the health of the surrounding ecosystem in which it lives.

When the Spanish arrived in America, the Jaguars inhabited the forests from Northern California to Patagonia. Today their range has been considerably restricted, having become extinct in much of the tropical region.

The jaguar is hunted for its valuable skin, despite being a forbidden activity, which reaches high prices on the international market. In the 1960s alone, more than 20,000 jaguar skins were exported to the United States. Europe is also in the areas of destination of these skins at high prices, which causes the decline of the population of this animal.

It should be noted that, except for man, the wild jaguar is the only predator capable of controlling populations of large herbivores, such as deer, tapirs and wild pigs. Unlike what happens in the African plains or the northern temperate forests, in the Amazon the amount of prey is reduced in relation to the extension of the forest, so the Otorongo must resort, in much of its diet, to small animals such as rodents, turkeys, partridges, lizards, snakes, monkeys and sloths.

As for the species of wild flora, it is detailed below:

TABLE 120: LIST OF HARVESTABLE FOREST SPECIES UNDER THREAT

Common Name	Scientific Name	DS 043-2006-AG	CITES	IUCN
Huicungo	*Astrocaryum carnosum*	NT		VU
Huicungo	*Astrocaryum huicungo*	NT		
Ishpingo, Cumaru de Cheiro	*Amburana cearensis*	VU		EN
Cedar, White Cedar, Tall Cedar	*Cedrela fissilis*	VU		VU
Red Cedar	*Cedrela odorata*	VU	III	VU
Huimba Colorada, Lupuna	*Chorisia integrifolia*	NT		
Ceiba, Huimba, Lupuna	*Ceiba pentandra*	NT		LC
Mashonaste, Amarillo, Tulpay	*Clarisia racemosa*	NT		LC
Copaiba	*Copaifera paupera*	VU		LC
Quinilla Roja	*Manilkara bidentada*	VU		
Itahuba	*Mezilaurus itauba*	VU		
Tahuarí	*Tabebuia incana*	VU		
Tahuarí, Asta de Venado, chonta	*Tabebuia serratifolia*	VU		
Mahogany	*Swietenia macrophylla*	VU	II	VU

Source: PGMF Otorongo, PGMF Chullachaqui

According to INRENA's legal norm DS. 043-2006-AG, which approves the categorization of threatened species of wild flora in Peru, 10 species of trees with commercial value present in the consolidated

Chullachaqui are considered Vulnerable (VU) and five species are considered Near Threatened (NT). According to CITES, mahogany (*Swietenia macrophylla*) is listed under CITES II and red cedar (*Cedrela odorata*) is listed under CITES III.

Two species of high social and ecological value are also present: The Brazil nut (*Bertholletia excelsa*) and the shiringa tree (*Hevea brasiliensis*), which is extracted for its fruits and resins. Although these two species do not have IUCN or CITES conservation categories, they are strictly protected by the State, which grants them rights as concessions for Brazil nut or shiringa harvesting to develop complementary harvesting activities. It should be noted that the slashing and burning of Brazil nut trees was declared a closed season for an indefinite period by Ministerial Resolution N°0729-81-AG-DGFF; and then the prohibition of slashing and burning of Brazil nut trees was decreed in Supreme Decree N°044-2002-AG.

Other forest species of diverse importance are the aguajales where some palm species are located such as Shapaja (*Attalea phalerata*), Huasai (*Euterpe precatoria*), Huicungo (Astrocaryum sp.) and Aguaje (*Mauritia flexuosa*). These palms are part of the diet of many wild animal species (Bodmer 1993), as are Sapote (*Matisia cordata*), Charichuelo (*Rheedia floribunda*), Almendro (*Geoffroya striata*), Chimicua (*Pseudolmedia laeviata*), Congona (*Brosimum sp.*), Shimbillo (*Inga ruiziana*) and Uvilla (*Pourouma cecropiaefolia*).

5.1.2 High Conservation Values (B1.2)

TABLE 121: BIODIVERSITY HCV

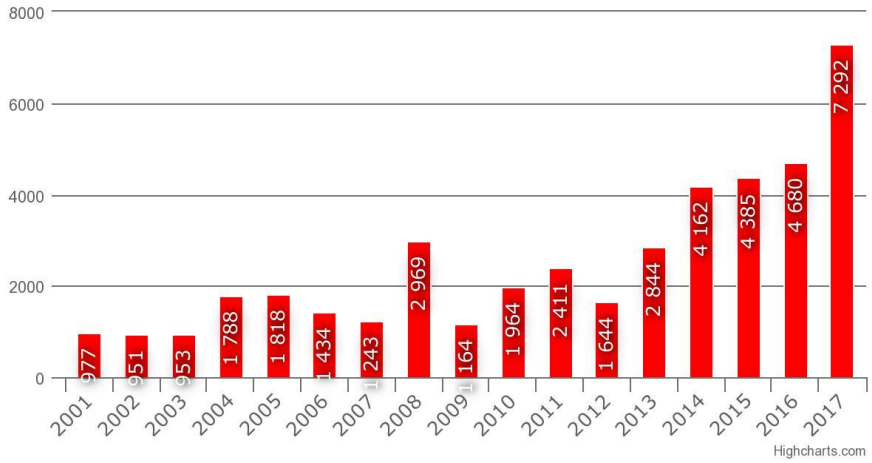
High Conservation Value	Otorongo or Wild Jaguar (Panthera onca), a threatened species according to all existing classification criteria.
Qualifying Attribute	As a result of the protection measures, the project area is home to a population of jaguars more concentrated than the surrounding forest areas. Nearly 40 different wild species of this endangered species have been identified in the concession area.
Focal Area	The project area covers approximately 185,000 hectares under the FSC-certified sustainable forest management system between the Manuripe, Muymanu and Tahuamanu river basins, at the northeastern tip of the Madre de Dios region.

High Conservation Value	The entire area of the project, due to its large area of more than 185,000 hectares
Qualifying Attribute	Key area for the connectivity of species, especially large mammals and the hydro biological processes involved; there are sites of great importance to wildlife such as: collpas, avocados, pacales, marshland, Brazil nut, river-dwelling, streams and lowlands. In addition, the Consolidated respects the 25-50-metre fiscal straw as a buffer area for watercourses, thus maintaining hydro biological processes and limiting their pollution.
Focal Area	The project area covers approximately 185,000 hectares under the FSC-certified sustainable forest management system between the Manuripe, Muymanu and Tahuamanu river basins, at the northeastern tip of the Madre de Dios region.

5.1.3 Without-project Scenario: Biodiversity (B1.3)

In the no-project scenario, the forest loss trend of Tahuamanu province would be the most likely scenario that would occur in the project area. The following chart shows that, since 2012, deforestation in Tahuamanu province has grown exponentially, having increased almost five times in just five years.

CHART 16: FOREST LOSS IN TAHUAMANU PROVINCE



Being the main threat to biodiversity, the fragmentation and loss of habitat due to the advance of the agricultural frontier, agricultural and mining activity among the main ones.

The expansion of the agricultural frontier is caused by the continuous and accelerated pressure on the lands on both sides of the Southern Inter-Oceanic Highway (IOS) mainly by Andean migrants. They replicate traditional slash-and-burn practices, deforesting areas covered with forest, to carry out clean agriculture or intensive grazing. It is estimated that the change in land use for agriculture is growing at an annual rate of 1.29% in reduction of primary forest and 0.66% of secondary forest. Likewise, the implementation of pastures for cattle raising registers the highest annual growth rate, reaching 3.51% in reduction of secondary forest and grasslands.

In the CDC-SZF-INRENA study (2007), in section 3 of the IOS, which includes and surrounds our project area, it refers to agricultural activity (farming and livestock activities) as the main source of deforestation, representing 94.2%; agriculture 3.37% and the rest is a result of infrastructure. Likewise, the habilitation and maintenance of the IOS brings with it indirect impacts on the surrounding forests; these impacts according to Dourojeanni (2006) would be:

- Deforestation, by legal and illegal agriculture in soils without agricultural aptitude.
- Forest degradation, due to forest extraction without management and replacement. The harvested species of cedar and mahogany represent 90% of the volume exploited, most of which is illegal. Myers (1980) estimates that for every m3/ha exploited, the farmers who subsequently invade the areas destroy approximately 1/5 ha of forest.
- Increased risks of forest fires (natural causes or induced fires resulting from slash-and-burn practices)
- Illegal hunting, for trade in meat, hides and skins and trafficking in live animals.

- Reduction of environmental services of the forest (water cycle, CO2 fixation, etc.).
- Loss of biodiversity and extinction of species, and the invasion of protected areas This will result in the reduction of the landscape and tourist value of these ecological niches.

Informal mining recorded, according to our calculations, a growth rate of 3.62% per year. This increase is stimulated by the international price of gold and the lack of control mechanisms and tax inspection, which allows all mining activity to be informal, becoming a serious environmental and social threat in continuous expansion.

Mining in Madre de Dios is carried out with heavy machinery and dredging in the rivers, which produces negative impacts such as the alteration of surface water quality due to land removal; the dumping of chemicals, oils, lubricants and fuels that puts aquatic fauna at risk; direct destruction of flora and fauna, alteration of biodiversity, and alteration of the habitat due to the movement of vehicles and heavy machinery.

The area is ecologically balanced. The species and habitat communities in the forest are inherently stable, but could be susceptible to alteration if there is a drastic modification of the environment with changes in land use or indiscriminate logging.

5.2 Net Positive Biodiversity Impacts

5.2.1 Expected Biodiversity Changes (B2.1)

TABLE 122: EXPECTED BIODIVERSITY CHANGES

Biodiversity Element	Otorongo or wild Jaguar (Panthera onca)
Estimated Change	Maintenance and increase of the jaguar population
Justification of Change	The maintenance of the concession forest and the adjacent forest are the main factors that will allow this change to be generated, as a consequence of the fact that this is a project based on selective and low-impact logging management, allowing natural regeneration and the growth and reproduction of unharvested individuals. This allows for the conservation of almost intact forest cover, while guaranteeing the conservation of innumerable associated flora and fauna species, among them the Otorongo, an umbrella species at the top of the food chain pyramid. The forest thus maintains its rhythms and cycles in a similar way to how it developed thousands of years ago, maintaining its processes, and where species that are indicators of the health of ecosystems register healthy and growing populations (as is the case with top predators such as the Otorongo, the harpy eagle or the giant otter) and where other species that are highly sensitive to human presence (tapirs, deer, mountain pigs, paujiles and turkeys) maintain healthy populations. It is also worth mentioning that in the concession area, complementary activities to the sustainable use of the forest are carried out, among them, the monitoring of fauna through the "Jaguar Project", which is being carried out for the monitoring and evaluation of the populations of

	wild jaguars, implemented by PhD, Mathias Tobler of the San Diego Zoo, using a set of camera traps in different areas of the habitat of these felines. The images captured have allowed the identification of about 40 different specimens of wild Otorongos or Jaguars, an unusually high number, one of the largest recorded in the world. One of the factors of this high population density would be related to the proliferation of prey (deer, capybara, tapirs, and wild pigs, among others) in the forest tracts unrelated to human disturbance.

Biodiversity Element	136 species inventoried with timber potential
Estimated Change	Sustainable forest management with FSC certification and Chain of Custody (CoC) certification.
Justification of Change	The project is based on selective and low-impact logging management by dividing the area under sustainable forest management into a total of 20 cutting plots, which will be harvested annually (one part each year) and at a certain intensity of harvesting (the design considers a cutting cycle every 20 years, resulting in less than one tree per Ha being harvested every 20 years), allowing natural regeneration and the growth and reproduction of unharvested individuals. A great diversity of species (136) with timber potential has been inventoried. The methodology includes the approval of a General Forest Management Plan and the preparation of the Annual Operating Plan, which begins with a forest inventory, in which the variety and quantity of potential species to be harvested is recorded. This makes it possible to know the number of individuals of each species that are suitable for harvesting, and the approximate volume of wood that they will generate, which makes it possible to calculate and control, among other things, the total volume of wood to be harvested. This makes it possible to identify the seed trees (approximately 20% of the total number of individuals to be harvested) that are kept in the forest, guaranteeing the production of seeds and ensuring the survival of the species and favoring their natural regeneration. Felling is done by directing the fall and minimizing damage to the surrounding vegetation, so that the clearings left in the forest are of similar dimensions to those created by the natural fall of the trees. This favors regeneration since the entry of light into the clearings triggers the growth of seedlings that remained in a dormant state under the shade of the parent tree. This allows the conservation of the forest cover almost intact, guaranteeing in turn the conservation of innumerable species of associated flora and fauna. To this end, the project has trained personnel, created infrastructure and adapted the processes necessary to obtain the Sustainable Forest Management Certification - FSC 100% - guaranteeing an environmentally sustainable, socially inclusive and economically viable model. It also has certification of its Chain of Custody (CoC), which guarantees that the product it sells reaches the customers respecting the traceability processes and the three pillars of sustainability (environmental, social, and economic). In this way, the forest maintains its rhythms and cycles in a similar way to how it developed thousands of years ago, maintaining its processes, and where the species that indicate the health of the ecosystems register healthy and growing populations.

5.2.2 Mitigation Measures (B2.3)

There are no expected negative impacts on biodiversity as a result of the implementation of the project activities.

The company has implemented a number of measures to maintain natural patterns and processes and avoid fragmentation. These measures include: voluntarily limit mahogany logging (Swietenia macrophylla), because it is endangered, regularly conduct timber and wildlife inventories to better understand the forest ecosystem, implement small impact measures to limit the potential impacts of activities, logging based on scientifically sound reconstitution rates for the main timber species, increasing the minimum diameter of short above the legally required diameter, tree protection seedlings and trees considered important for wildlife. The use of reduced impact techniques to minimize momentary interference caused by extraction operations. Rare logging is not carried out or very large clear, so there is no fragmentation of forest resources.

5.2.3 Net Positive Biodiversity Impacts (B2.2, GL1.4)

The current good condition of wildlife within the Consolidated Area is apparently due to the prohibition of hunting, the implementation of reduced impact harvesting techniques, surveillance and control actions, and process monitoring and continuous staff training.

Despite the fact that hunting pressure is very low or almost non-existent thanks to the control mechanisms carried out by both concessions, the roads and trails used for timber extraction within the concession area and the proximity to the IOH will facilitate access by illegal hunters. Continuous and permanent patrols are needed throughout the area to ensure that no illegal hunting activity takes place within the concession area, an objective that should be achieved only through carbon finance.

On the other hand, fauna monitoring through the "Jaguar Project," which is being carried out to monitor and evaluate the populations of wild otorongos or jaguars. Nearly 40 different specimens of otorongos have been identified, an unusually high number, one of the largest recorded in the world.

It should also be noted that the Project contemplates other complementary activities for the sustainable use of the forest, such as:

a. Sustainable use of Brazil nuts, through a participatory partnership scheme with a group of organized local people (about 40 families from the localities in the area of influence) through a low-impact harvesting activity, under rules of behavior consistent with the custody of the forest, care of the environment and water flows. By consolidating the collection carried out, and being in charge of marketing, the Project has obtained better dividends that benefit the extractors.

b. Production of charcoal, using the residues of the sawing activity, allowing the disposal of waste in the field, and reducing the pressure of cutting standing species for charcoal in other areas.

c. The acquisition of private land allows the development of an ecotourism project aimed at birdwatchers, naturalists and wildlife lovers, which harmonizes environmental conservation with income generation for its management and sustainable use.

5.2.4 High Conservation Values Protected (B2.4)

Demonstrate that no HCVs related to biodiversity are mutually affected by the project.

Targeted and low-impact logging does not adversely affect any HCV, but sustainable harvesting favors the conservation of almost intact forest cover, while ensuring the conservation of countless species of associated flora and fauna as well as of jaguar and other endangered species, which were shown in a table above.

The study carried out by Toddler, et al. (2018) within FSC-certified concessions to evaluate the Jaguar population in Guatemala and Peru. I determine, within the Consolidated Otorongo, a population density of Jaguars of 4.5 individuals per 100 km2 and emphasizes that this data is comparable only with protected natural areas. Concluding that the intensity of forest harvesting in the consolidated, the same system used in the consolidated Chullachaqui, adequately protects the Jaguars and thus other species; and that extraction has a positive impact on the diversity and abundance of certain species. Furthermore, states that certified concessions allow connectivity between protected areas and natural forest; this is due to the absence of hunters in concessions as a measure to protect the biodiversity that inhabits them.

In this regard, the high conservation values identified for the project such as the area per se of more than 180 thousand hectares and the jaguars are not affected by the harvesting activities.

5.2.5 Species Used (B2.5)

According to the General Forest Management Plan of both Consolidated, the following species are planned to be harvested. It also specifies the Minimum Cutting Diameters (MCD) that these species must reach in order to be considered for harvesting. It should be noted that the MCDs stipulated below are larger than those established by the current regulations in most cases.

TABLE 123: HARVESTABLE SPECIES

N°	COMMON NAME	SCIENTIFIC NAME	DMC (cm)	CHULLACHAQUI	OTORONGO
1	Ana Caspi	*Apuleia leicarpa*	70	X	X
2	Huayo sugar	*Hymenaea sp*	80	X	X
3	Bolaina	*Guazuma crinite*	41		X
4	Cachimbo	*Cariniana decandra*	70	X	X
5	Mahogany	*Swietenia macrophylla*	75	X	X
6	Capirona	*Calycophyllum spruceanum*	41	X	X
7	Catahua	*Hura crepitans*	60	X	X
8	Catuaba	*Qualea sp*	41	X	
9	Cedar	*Cedrela odorata*	65	X	X
10	Copaiba	*Copaifera reticulate*	56	X	X
11	Cumala	*Virola sp*	46	X	X

12	Estoraque	*Myroxylon balsamum*	55	X	X
13	Huayruro	*Ormosia sp*	46	X	X
14	Caspian Macaw	*Sumira rubescens*	41	X	X
15	Huima	*Ceiba pentandra*	51	X	X
16	Ishpingo	*Amburana cearensis*	69	X	X
17	Itauba	*Mezilaurus itauba*	41		X
18	Lupuna	*Chorisia integrifolia*	64	X	X
19	Machinga	*Brosimum alicastrum*	41	X	X
20	Mashonaste	*Clarisia racemose*	65	X	X
21	Misa	*Eschwiilera sp*	80	X	X
22	Moena	*Aniba sp*	46	X	X
23	Cane Stick	*Crepidospermum goudotianum*	41	X	X
24	Pashaco	*Schizolobium sp*	51	X	X
25	Pumaquiro	*Aspidosperma macrocarpon*	69	X	X
26	Quillobordon	*Aspidosperma subincanum*	38	X	X
27	Quinilla	*Manilkara bidentata*	70	X	X
28	Requia	*Guarea trichiloides*	46	X	X
29	Shihuahuaco	*Dypteryx odorata*	71	X	X
30	Tahuari	*Tabebuia serratifolia*	70	X	X
31	Tornillo	*Cedrelinga catenaeformis*	80	X	
32	Zapote	*Quararibea cordata*	41	X	X

Of these species, mahogany and cedar are the only ones that require a special permit for harvesting because they are species listed in Appendix II and III of CITES. In Art. 130. of FFS Law No. 29763 the CITES Management Authority approves the annual export quota of mahogany (Swietenia macrophylla) including the export of sawn wood, plywood or veneer sheets in accordance with the CITES annotation of the species.

The export quota is established for as long as this species is considered in CITES Appendix II and is defined on the basis of the recommendations of a non-detriment finding by the CITES Scientific Authority, and takes into account performance studies, among other relevant information. The general guidelines for the export quota are defined by supreme decree with the endorsement of the Ministers of Agriculture and Environment.

5.2.6 Invasive Species (B2.5)

The forestry management used in both consolidations is of the type of entresaca polycyclic, i.e., it exclusively manages the mass on foot favoring the growth of commercial species without eliminating undesirable species. In addition, this system allows forest dynamics to continue as it allows for several

periods of years of rest in the previously exploited area. Therefore, there would be no possibility of the area being affected by invasive species.

5.2.7 Impacts of Non-native Species (B2.6)

Not applicable.

5.2.8 GMO Exclusion (B2.7)

Not applicable.

5.2.9 Inputs Justification (B2.8)

Not applicable.

5.2.10 Waste Products (B2.9)

The Consolidated companies have a Waste Management Manual, which refers to all technical operating activities involving segregation, handling, storage, transport, treatment, final disposal or any other technical operating procedure used from generation to final disposal.

The waste was identified as: hazardous, non-hazardous, the main waste produced during the wood harvesting process is detailed below.

TABLE 124: WASTE PRODUCED BY LOGGING ACTIVITY

Source	Waste	Kind
Kitchen a Dining room	leftover food	Organic
	Plastic bottles	Common
	Uncontaminated cans	Common
	Glass bottles	Common
Offices	Waste paper	Common
	Cardboard	Common
	Ink cartridges, toners	Dangerous
	Batteries	Dangerous
Camping Installation	Cable waste	Dangerous
	Rests of plastics	Dangerous
Bedrooms	Papers	Common

	Plastics	Common
	Textile remains	Common
Workshops	Used oils	Dangerous
	Contaminated rags and wipes	Dangerous
	Hydrocarbon Remnants	Dangerous
	Metal residues	Common
	Used filters	Dangerous
	Used gloves	Dangerous
All	Medical Services	Dangerous

Waste management covers the following aspects:

- Waste minimization, under the principle of reduction, recovery, reuse and recycling
- Waste segregation, hazardous and non-hazardous (organic or common)
- Storage of waste, organic waste in metal containers and transported to the burial pool areas, and waste not suitable for burial will be transported to the external landfill.
- Handling of waste, organic waste is classified if it comes from the kitchen (biodegradable waste pits) or from bathrooms and showers (treated by a system of bio digesters or by organic filters); common waste is put in recycling containers, hazardous waste requires handling with personal protective equipment and is put in the corresponding containers.
- Collection system: Waste is transferred from the different places where it is generated to the temporary waste storage area in the camps, which must be covered.
- Disposal of waste in permanent, sanitary and environmentally safe places.
- Training of personnel to ensure the correct application of the plan.

In addition to those mentioned above, in the sawing phase, waste is produced that is used in the production of charcoal, allowing the disposal of waste in the field, and the reduction of logging pressure on standing species for charcoal in other regions. The production obtained in twenty furnaces at a rate of 1.5 cycles per month generates a volume of more than 90 metric tons of coal per month, which is destined to the local market and cities in southern Peru (Cusco, Arequipa and Puno).

5.3 Offsite Biodiversity Impacts

5.3.1 Negative Offsite Biodiversity Impacts (B3.1) and Mitigation Measures (B3.2)

TABLE 125: NEGATIVE OFFSITE BIODIVERSITY IMPACTS AND MITIGATION MEASURES

Negative Offsite Impact	Mitigation Measure(s)
Increased deforestation pressure for the purpose of extending the agricultural and	Workshops on management of crops of interest, controlled burns, agroforestry systems, environmental crimes, etc. to adjacent communities.

livestock frontier in the areas adjacent to the concession.	
Increasing illegal logging of high commercial forest species in areas adjacent to the concession	Greater control on the entry and exit of third parties using the Concessions' transport routes as a transit zone to other areas.
Loss of biodiversity due to increased illegal hunting of wildlife in areas adjacent to the concession	Greater control over the entry and exit of third parties who use the Consolidated transport routes as a transit zone to other areas. Workshops and preparation of informative documents (triptychs, brochures, etc.) on the importance of wildlife to adjacent communities.

5.3.2 Net Offsite Biodiversity Benefits (B3.3)

Under the principle of adaptive management, unmitigated off-site impacts on biodiversity will be identified during the course of the project and strategies and activities to reduce negative impacts generated by the project will be reassessed.

The measures adopted will focus mainly on continuously training the local population on the benefits and appropriate use of the forest resources through informative and educational talks.

On the other hand, although there has been an increase in the pressure of deforestation for the purpose of expanding the agricultural and livestock frontier in the areas adjacent to the concession, this has contributed to the high population density of otorongos or wild jaguars in the concession area, which has become a refuge area because it is a space with minimal human disturbance.

5.4 Biodiversity Impact Monitoring

5.4.1 Biodiversity Monitoring Plan (B4.1, B4.2, GL1.4, GL3.4)

The Environmental Management Strategy[37] considers an Environmental Management Plan that identifies and characterizes all the measures that will be carried out to prevent, mitigate and/or correct the identified environmental impacts. With respect to the biodiversity component, the following is detailed. This plan is having been designed to be used in each PCA.

[37] Environmental Impact Study Semi detailed (EIS-sd), Category II, Consolidated Otorongo (2018) and EIS-sd Chullachaqui (2018)

TABLE 126: ENVIRONMENTAL MONITORING PLAN

Impact Description	Environmental Control Measures	Monitoring Measures	Frequency	Responsible
Total loss of vegetation cover	*Efficient road network planning and building roads with the precise and appropriate technical specifications, avoiding unplanned deforestation.*	*Evaluate the dimensions of roads and collection yards in strategic locations.*	*Once a year in dry season*	*Operational Sub-Management*
Habitat destruction and alteration for threatened or endangered species. Nesting sites, collpas, etc.	*Avoid destruction and alteration of habitat of endangered or endangered species*	*Supervision of compliance with what is established. A report will be issued with UTM coordinates of the wildlife sightings and burrows found; which will be submitted to the Regional Natural Resources and Environmental Management Office at the end of the harvest.*	*Once a year in dry season*	*Operational Sub-Management*
Altered connectivity	*On the roads maintain forest canopy contact points for the movement of wildlife*	*Review the existence and number of forest canopy contact points on roads.*	*Once a year in dry season*	*Operational Sub-Management*
Partial loss of vegetation. Destruction of unplanned and naturally regenerating trees Invasion of herbaceous or weeds.	*Use of controlled logging techniques in the opening of roads. Use of controlled felling to avoid the fall of unplanned trees. Selective cutting of vines. Efficient planning of trailing roads to open the least amount of forest. Selective cutting of lianas (silvicultural treatments)*	*Evaluate areas with a greater presence of canopy opening, due to the effect of exploitation. Evaluate the existence of fallen trees not foreseen by the effect of harvesting.*	*Once a year in dry season*	*Operational Sub-Management*
Loss of genetic resources and structure of harvested species	*The minimum cutting diameter and cutting intensity shall be respected. A minimum of 10% of seed trees will be left (regulation by the forest authority) which will be marked during the census.*	*Sampling plots to determine the resilience of the forest, do not cut trees below the DMC. Number of existing seed trees.*	*Once a year in dry season*	*Operational Sub-Management*
Reduction of wildlife populations by poaching. Displacement of fauna	*Hunting ban. Control and sanctions inside and outside the forest concession. The trucks will not transport people outside the concession. Drivers and their assistants are prohibited from hunting and transporting animals. Denunciation to the forest authority of people who are caught hunting. Promote the functioning of the Forest Management Committee to control poaching.*	*Wildlife Monitoring*	*Once for harvest*	*Operational Sub-Management*
Illegal logging	*Signposting, boundary maintenance, systematic patrolling and monitoring, promotion of the functioning of the Forest Management Committee and permanent communication with the forest authority*	*Carry out patrols in areas most prone to illegal logging. The list of the duly accredited consolidated forestry Custodians shall be presented in the end-of-harvest report of each GWP.*	*Permanently*	*Operational Sub-Management*

In additionally, Permanent Evaluation Plots (PPE) are established with the objective of evaluating the growth and yield of species. We will use the methodology outlined in the document "Guide for the Installation and Evaluation of Permanent Sampling Plots" (BOLFOR; PROMABOSQUE 1999).

The main objective of the methodology developed is to obtain information about the response of the forest to the exploitation of the forest. The plots will be installed and measured before harvesting and will be remedied once harvesting is complete. Successive measurements will be made every three years, for a minimum period of 12 years, starting from the year in which the first plot was installed.

For each of the cutting intensities determined with the species of interest the aim is to ensure their sustainability, therefore, it is necessary to obtain the following information for each of the species to be favored:

- Abundance and Dominance, will allow us to know: usable mass, usable future potential and population behavior
- Recruitment and mortality rates, the regeneration capacity of the species of interest and the probability that such regeneration will establish itself as the usable mass in the future.

These two criteria are determined in intervened PCAs, establishing in this case a baseline of the presence of species of interest below 10 cm in diameter inside the plot after harvesting, in order to evaluate the response of these species to the actions taken. During the inventory, the name of the species and the category to which it belongs are specified.

Twenty permanent evaluation plots of one ha each will be installed (recommended for UMs with areas of 100,000 ha). The distribution will be random in the area of the PCA to be exploited. Measurement will be done before and after harvesting and then every 3 years.

Once the sampling plots are installed, the diameter of each of the individuals found for the species under study will be measured triennially, in each diameter class.

- Diametric increase, this measurement will be taken at the height of the DAP
- Fruiting diameter, refers to the diameter that defines the productive maturity of the tree, the same that must ensure the reproductive capacity of the species. It is measured 1.30 m from the ground.

In addition, with respect to the High Conservation Value Forests, the "Guide for the identification of High Conservation Value Forests (HCVFs) in Peru" elaborated by CFPERU (FSC Initiative - Peru) is used as a basis.

Consolidated Otorongo:

AVC1. Significant concentrations of biodiversity values at global, regional or national level and at the Chullachaqui Consolidated:

HCV1: Significant concentrations of biodiversity values at global, regional, or national levels

HCV2: Globally, regionally or nationally significant large landscape scale forests and the proposal for actions to conserve areas of importance for wildlife are:

- Identify and geo-reference the areas of importance for wildlife in the concession.
- Monitor spaces of importance for wildlife in the concession.

For fauna, the evaluation of the state of conservation for each consolidated is presented as an approach to the methodology for wildlife monitoring and will be done every time it is required to FSC.

The strata (habitats) identified that derive from the vegetation map are aguajal (swamp), lowlands or floodable forests, forests associated with Brazil nut groves and forests associated with pacales (a type of woodland). The transects covered three of the four habitats.

Monitoring includes night and daytime animals, and the data is collected using the method of transecting, which consists of traversing transects (tracts) established in the study areas with distances not less than 4 km linear during the day and night in order to make direct (seen and heard) sightings of animals or by signs of their presence (footprints, traces or smells). In addition, booby-traps will be used along the transects, in places with footprints, small collpas, swimmers, fruits. Each single group or animal is counted as a register, taking care to count the same group or animal seen by several observers more than once.

We estimate the abundance per taxonomic group based on the number of records during the inventory. We classify abundance in descending order into five classes: abundant, more common, common, less common, rare. Animals that were not registered were classified as "expected"[38]. These are broad categories and take into account the expected abundance of the animal concerned and whether the records are based on actual observations or secondary evidence:

- Abundant: describes commonly observed species or where secondary evidence is very common, such as footprints.
- More common: describes species that are sometimes observed or whose secondary evidence is common.
- Common: refers to animals that are not difficult to observe or whose secondary evidence is normally present in the area, but not as extensively as the "most common" species.
- Less common: is a category that includes species that are not normally common but are recorded more than once.
- Rare: is used for species that are rarely observed but that were registered at least once.

The cabinet contrasts the information with the specific richness of the zone or list of species, determines presence-absence, absolute and relative abundance and relative frequency.

This monitoring should include the following:

1. Training concession personnel to monitor areas of importance for wildlife.
2. Obtain relevant information on the spaces of importance for wildlife according to the corresponding format.
3. Elaborate a database with the information generated, which should be dynamic and able to be updated eventually.
4. Analyze the information generated during monitoring.
5. Interpret the information for decision making to achieve conservation of areas of importance for wildlife.
6. Respect spaces of importance to wildlife during the implementation of the POA.
7. Lay out the routes for the extraction roads at prudential distances from the spaces that are used by the wildlife.
8. Do not approach mammal clay licks on the ground more than 100 m away.
9. Identify the nests of species such as macaws (Ara spp) and harpy eagles (Harpia harpyja) so as not to cause negative impacts when approaching them.

[38] With regard to the list of threatened species in the area.

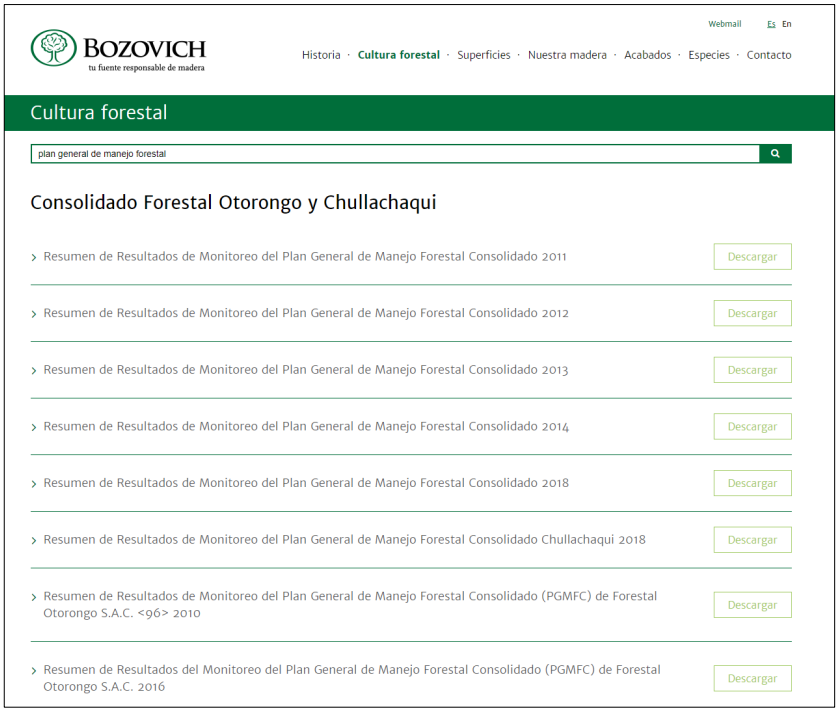
5.4.2 Biodiversity Monitoring Plan Dissemination (B4.3)

The results of the Monitoring and High Conservation Value Forest (HCVF) assessments and related documentation are uploaded to the official Project proponent[39] website for dissemination. This is shown in the following figure and the online address is http://www.bozovich.com/cultura-forestal/

Moreover, in the case of FSC certification, as part of its public announcements on its official page for Peru, which is https://pe.fsc.org/es-pe

For the dissemination with the surrounding communities, it is carried out through the social manager, through informative workshops and meetings with representatives and residents.

CHART 16: COMPANY WEBPAGE



5.5 Optional Criterion: Exceptional Biodiversity Benefits

5.5.1 High Biodiversity Conservation Priority Status (GL3.1)

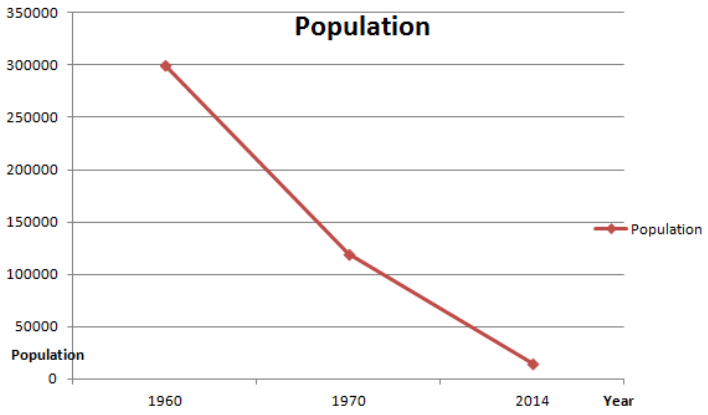
In the flora and fauna study carried out to obtain FSC certification for both consolidated species, the presence of Ishpingo (Amburana cearensis) was found to be the only exploitable commercial species listed as Endangered by the IUCN (2019).

[39] Bozovich Company is in charge of the commercialization of the wood extracted from the Consolidated Otorongo and Chullachaqui.

The project may obtain the Gold Level for exceptional biodiversity benefits thanks to the fact of being a high biodiversity conservation priority status because the project zone meets the criteria of hosting an UICN Red List endangered species, Panthera Onca (in the near threatened category), in a population of at least 83.25 individuals.

5.5.2 Trigger Species Population Trends (GL3.2, GL3.3)

TABLE 127: TRIGGER SPECIES

Trigger Species	Jaguar (Panthera onca)
Population Trend at Start of Project	Yet today, jaguars have been almost eliminated from the United States and populations in Central and South America are falling because of habitat destruction, trophy hunting and conflict with humans. Jaguars are listed as "Near Threatened" on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species. Although they still exist in countries such as Arizona and Mexico, the species only inhabits 40% of their original, historical range (Panthera Inc, 2014). In the mid-1800s, the jaguar population extended from Southern Brazil north to Central America, and along west coasts of Mexico. Jaguars could be found in the southwestern United States, and as far north as the Grand Canyon in Arizona (Tony Davis, 2013). There were an estimated 400,000 jaguars roaming in the wild. In the 1960s and 1970s, approximately 18,000 jaguars were killed each year (Panthera Inc, 2014). By 1996, the jaguar population was almost completely eliminated from the United States. Only four jaguars sighted in New Mexico and Arizona established that the population still inhabited the U.S, and the jaguar is now listed as an endangered species in these areas by the U.S. Fish and Wildlife Service. Today it is estimated that only 15,000 jaguars remain in the wild, and have been protected under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) since 1973 (Tony Davis, 2013). As number of jaguars has drastically declined in the past 150 years, the pattern of growth exhibited by the species is exponential decay. The birth rates of the jaguars are declining as their death rates are increasing, and this is causing their numbers to steadily decline.  With 22,000 jaguars in its territory, Peru is the second country in South America with the largest number of jaguars after Brazil; however, this figure is half of what

	should be registered, according to the corporate sustainability program Conexión Jaguar. According to international research, it is estimated that for every 100 square kilometers of protected areas in the Amazon there are 4.5 jaguars, and in unprotected areas the number is reduced by half. The threats to jaguar survival are increasing. Illegal trade and poaching have increased in recent years due to a growing demand for their tusks in the Asian market. This situation, coupled with the loss of its habitat, is accelerating the risk of extinction for the species. A bleak outlook for the region's largest cat. For this reason, Peru has asked CITES to recognize the jaguar as a flag species of the American countries where it lives and to adopt special measures to protect it. Describe recent population trend in the project zone at the start of the project. Estimate numbers, if possible
Without-project Scenario	As can be seen from the information presented, there are no accurate statistics on the jaguar population in the Americas or in Peru. However, what all researchers agree on is the fact that this population is decreasing at an alarming rate as a consequence of the effects on its habitat and the fragmentation of the biological corridors that this species requires for its survival. As can be seen in the adjacent areas, the loss and degradation of the forests is increasing with the consequent negative impact on the jaguar population and pushing this population towards the protected forests of the project area.
With-project Scenario	The study by Tobbler[40] et al (2018) within the Consolidated indicates that the population density of the Jaguar (4.5/100km2) is comparable to data from natural protected areas. These measurements were made through camera traps placed in strategic locations within the forest and extraction roads. The Jaguar is an indicator of the good condition of the forest, its presence alone would demonstrate that the ecological processes of the forest are optimal and that the logging carried out does not generate a negative impact on biodiversity but on the contrary is a bridge for the transit of countless species, improving the connectivity between natural protected areas and the project.

[40] Tobbler, *et al.* (2018) Do responsibly managed logging concessions adequately protect jaguars and other large and medium-sized mammals? Two case studies from Guatemala and Peru. Biological Conservation 220 (2018) 245-253

APPENDICES

Appendix 1: Stakeholder Identification Table

Developed in Section 2.1.9

Appendix 2: Project Activities and Theory of Change Table

Developed in Section 2.1.11

Appendix 3: Project Risks Table

Developed in Section 2.1.18

ANNEXES

1. Coordinates of forest concessions
2. Project Cash flow under two scenarios: with REDD+ activities and incomes and without them
3. Social diagnosis of neighboring communities
4. Institutional Policy
5. Occupational Safety and Health Policy
6. Key personnel CVs
7. Anti-corruption guidelines
8. Forest concession contracts
9. Forest management plans
10. Specialists interviewed, questionnaire and responses
11. Handbook for conflict resolution
12. Statistical Report
13. Master Plan for Permanent Production Forests of Tahuamanu presentation
14. Summary of FORESTAL OTORONGO Handbooks